CLASSIFICATION OF INTERACTIONS DUE TO HIGH-SPEED FLOWS PAST TRANSVERSE JETS

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CLASSIFICATION OF INTERACTIONS DUE TO HIGH-SPEED FLOWS PAST TRANSVERSE JETS

by

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SUMMARY

A preliminary analysis of flows past transverse jets indicates that if reaction jet control is used within the atmosphere strong interference effects can be expected. The assumptions necessary and earlier analyses of this problem are reviewed herein. In this present introductory work a straightforward approach using two-dimensional, compressible, inviscid, perfect gas flow theory is adopted. Consistency is obtained in using the following three variables to define the problem: free stream Mach number, design Mach number of the jet nozzle, and the ratio of jet stagnation pressure to free stream static pressure. Many basically different types of interaction flows are possible depending upon the values of the variables. Different theoretical methods are necessary to evaluate widely varying interference effects. Interaction flows are classified, and values of the variables separating the different types are tabulated. Sample force calculations indicate that the induced control force may be several times larger than the pure reaction force of the jet; this is particularly true for weak jets (jets having low pressure ratio values). Three-dimensional, viscid, and separation effects are qualitatively discussed; the need for experimental research is pointed out.

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SYMBOLS

A	cross-sectional area of jet flow
A_*	throat area of jet nozzle
A_c	minimum cross-sectional area of external jet flow
b	span of jet orifice
C_p	pressure coefficient; $C_p \equiv (p - p_1)/(\frac{1}{2}\rho_1 V_1^2)$
F_i	interaction force
F_{s1}	reaction force for jet exhausting into ambient air at pressure p_{s1}
F_v	reaction force for jet exhausting into a vacuum
g_1, g_2, g_3	functions defined in Eq. (9), p. 16
G	function defined in Eq. (9), p. 16
I	specific impulse of jet
ℓ	length downstream of orifice over which interference effects are felt
M	Mach number
p	pressure
P	pressure ratio; $P \equiv p_{j0}/p_{s1}$
R	ratio of jet orifice diameter to cylinder diameter
V	velocity
w	streamwise width of jet orifice
W	weight efflux of jet flow

γ	specific heat ratio of gas (taken as 1.40 for tables)
δ	stream flow deflection angle
δ_j	jet flow deflection angle
θ	shock wave angle
ν	Prandtl-Meyer angle
$\Delta\nu$	change in Prandtl-Meyer angle
ξ	static pressure ratio across stream shock; $\xi \equiv p_{s2}/p_{s1}$
ξ_j	static pressure ratio across jet shock; $\xi_j \equiv p_{j2}/p_{j1}$
ρ	density
ϕ	either the smallest or largest root of Eq. (9), p. 16

<u>Subscripts</u>*

0	stagnation condition
1	condition upstream of shock wave
2	condition downstream of shock wave
a	value for jet exhaustion into ambient air
d	jet nozzle design condition
e	condition at jet nozzle exit
f	final condition
j	refers to jet flow
s	refers to stream flow

*Subscripts are frequently grouped to denote a particular condition; e.g., p_{s20} is the stagnation pressure behind the shock wave in the stream flow.

Subscripts (Cont.)

v	value for jet exhaustion into a vacuum
*	condition at jet nozzle throat
I	value of P for which the jet nozzle flow is choked
II	value of P for which the jet flow final velocity is sonic
III	value of P for which the stream shock is sonic
IV	value of P for a strong stream shock
V	value of P for a strong jet shock
VI	value of P for which the jet shock is sonic
VII	value of P for a strong jet

INTRODUCTION

Reaction jets, aligned perpendicularly to the local air stream, are being considered as control devices for very high altitude vehicles (Ref. 1). Such devices are necessary because of the insufficiency of aerodynamic forces at the extreme altitudes at which controllable space and "near" space vehicles will operate. Our introductory look at the problem of analyzing the interaction flow fields caused by the use of reaction control jets within the atmosphere indicates the probability of large interference effects.

An adequate theoretical analysis of the interference effects must be developed for the safe and efficient use of reaction control jets. Static reaction forces and low speed flows past small diameter strong jets have been studied experimentally (Refs. 2 through 4), and interference effects have been noted for both subsonic and supersonic flows past such jets (Refs. 5 through 8). However, lack of adequate analysis has precluded the study of the beneficial use of the substantial induced forces. Induced forces may be equal in magnitude and may even surpass static reaction forces, depending upon flow conditions and jet nozzle shape.

Previous approaches to the problem were limited in scope because an external jet flow shape was assumed. In a categorical approach, it quickly becomes apparent that the flow picture varies greatly with stream and jet conditions. Different methods must be used to analyze the basically different types of interaction flows and to calculate the associated induced forces. Before analyzing in detail any one particular type of interaction flow, it was thought preferable to classify approximately the possible types. In keeping with this simplified approach, viscid and real gas effects are neglected in the categorization of the flows. Tendencies, at least, can be discussed using the perfect gas inviscid analysis. The important viscid and real gas effects may then be included for specific examples.

This report qualitatively establishes the various possible types of jet stream interaction flows and indicates the large induced forces which are available in certain cases. A simple theoretical model is used to arrive at order of magnitude results. The numerical analysis is presented for two-dimensional, inviscid, compressible fluid flow. Both jet and stream flows are assumed

to obey the ideal gas law and to have constant specific heat ratios equal to seven-fifths. The results of the analysis are tabulated in the Appendix and may be used to determine qualitatively which type of flow exists for given conditions or to estimate the values of the variables for a particular type of interaction flow. The work is thus of a preliminary nature, but serves as an introduction to a more thorough program based on a systematic, categorical approach to the problem.

ANALYSES OF INTERACTION FLOWS

Several analyses have been made of interaction flows which result from a jet issuing perpendicularly into an air stream (Refs. 2 through 8). Streamlines and, in some instances, induced forces were obtained experimentally. A few theories, based on the particular type of interaction observed, were postulated to corroborate experimental results. The wide range of values the variables may have makes the existence of many different types of interaction flows possible. In lieu of assuming a particular type of interaction flow, a straightforward categorical approach is followed which brings to light the possible existence of the many types. A two-dimensional, inviscid analysis is used in determining the salient features of the different flows.

Previous Approaches to Problem

In the past, the bulk of attention was directed to stream flows past strong jets, that is, jets having reservoir pressures many times larger than the free stream static pressures and issuing from orifices of small aspect ratios. The large pressure ratios and small orifices led to stream-jet interaction flow boundaries such as the one sketched in Fig. 1. The jets deeply penetrate the stream before being turned downstream; the phenomena are truly three-dimensional under these conditions.

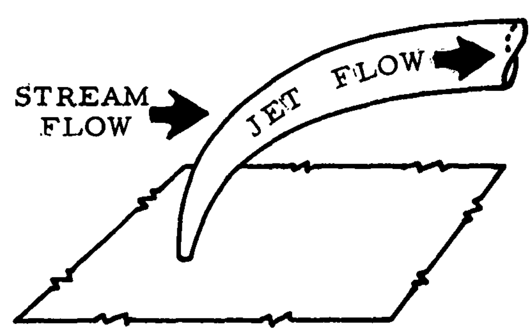

Fig. 1 - Strong Jet Flow Boundary

Penetration distances were measured at various downstream stations for varying jet and subsonic stream flow conditions for several different orifices (Refs. 2 through 4). An equivalent orifice diameter, the diameter of a circle having the same area, was defined for square and elliptic orifices.

The ellipses had major to minor axes ratios of 2:1 and 4:1 and were tested with their major axes parallel to the stream. An empirical relationship, nondimensionalized with respect to the equivalent orifice diameter, was obtained for the jet shape in terms of the jet and stream flow conditions. It was noted that there were essentially no boundary layer or other viscid interactions in these subsonic stream tests. Forces on the plate were found to be considerably larger than the pure reaction forces of the jets exhausting into still air. The additional forces were attributed to the interaction effects of the jet and the stream.

Induced forces were also noted for jets interacting with supersonic streams, and a few theories have been postulated to corroborate the experimental results (Refs. 5 through 8). A lengthy theoretical analysis was made for a strong jet issuing laterally into a supersonic stream from a circular orifice located on the side of a cylinder parallel to the free stream (Ref. 5). The standoff distance of the detached shock wave was estimated by using hypersonic blunt body theory for an approximately equivalent flow in the vicinity of the wall. The cylinder wall was represented as a flat plate, and the jet was represented as a cylinder perpendicular to both the free stream and the plate. The diameter of the cylinder representing the jet, many times larger than the diameter of the jet orifice, was determined by a pressure balance between the jet and stream flows. The jet expanded until its pressure decreased to the value of the stream stagnation pressure on a cylinder behind the detached shock wave. It was tacitly assumed that the jet expansion occurred discontinuously, as depicted in Fig. 2. The induced forces on the body, due to the pressure rise across the detached shock wave, and the forces on the transverse cylinder representing the jet flow were calculated. The next approximation to the jet flow was to represent it by the first quadrant of a torus, the minor diameter of which was chosen as the diameter of the

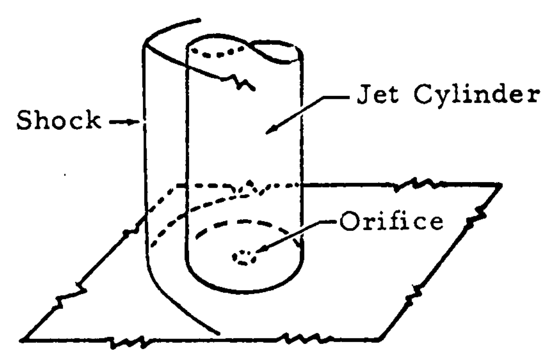

Fig. 2 - First Approximation of Ref. 5 to Jet Flow

original cylinder representing the jet flow. The major diameter of the torus, the rate at which the jet flow was bent downstream, was determined by a pressure balance between the jet and the stream flows. It was again assumed that the jet flow expanded suddenly upon emerging from the orifice to equalize the pressure. The induced force on the body was then taken to be the induced pressure on the body, caused by the pressure rise across the detached shock wave, in the region between the shock and the forward portion of the torus representing the jet flow. The induced pressure coefficient in the meridian plane was, from hypersonic blunt body theory, $C_p = (\gamma + 3)/(\gamma + 1)$, which varies between 1.83 and 2.00 as the ratio of specific heats γ varies between 1.4 and 1.0. Calculated induced forces were compared with the experimental results of Ref. 6. The comparison and conclusions drawn in Ref. 5 are discussed on page 7.

A two-dimensional theory was applied to the same type of jet interaction flows (Refs. 6, 7, and 8). Control jets near the base of an ogive cylinder were tested in supersonic free streams. The control forces normal to the body were measured for the jets exhausting into a vacuum, exhausting into ambient air, and then for the jets exhausting into the supersonic air streams. The interaction force, F_i, was defined as the difference between the total force exerted on the body due to the jet exhausting into the stream and the force, F_v, that would be experienced for the same jet exhausting into a vacuum. Again it was noted experimentally that the interaction of the jet and stream considerably magnified the normal forces. The two-dimensional model chosen for the theoretical explanation of the increased control effectiveness is shown on the next page in Fig. 3. The jet flow was assumed to be sonic at the jet exit of area, A_e, and to expand from its reservoir (stagnation) pressure, p_{j0}, to the value of the free stream static pressure, p_{s1}. The final unit cross-sectional area of the jet flow is A_f, the distance the stream flow must be diverted away from the wall. A slip line was assumed to exist between the jet and stream flows. The jet flow thus acted as a forward facing step; the stream flow separated before the step. The inviscid stream flow over the effective shape was taken as that over a wedge with an attached shock wave and then Prandtl-Meyer expansion. The final pressure, p_{sf}, was taken equal to the free stream pressure, p_{s1}. The calculation of the flow deflection angle, δ, is not accounted for in Ref. 6. It is stated that pressures just upstream of the jet must be assumed "judiciously." The interaction normal force of the jet, F_i, exerted on the wall is taken as the over pressure, $(p_{s2} - p_{s1})$, acting on

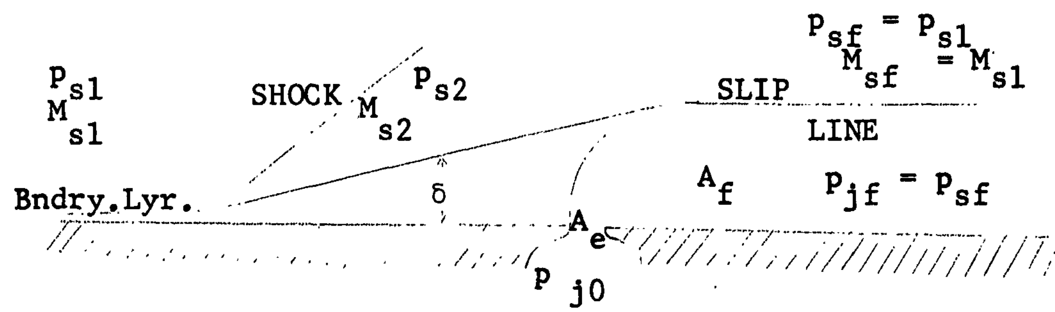

Fig. 3 - Theoretical Interaction Flow Model Used in Refs. 6, 7, & 8

the area upstream of the jet orifice, ($A_f/\tan \delta$). The interaction forces thus calculated were lower, by "about an order of magnitude" (Ref. 6), than those calculated using the "method of characteristics" with the same assumption that the final pressure was equal to the free stream pressure.

The above two-dimensional theory presented in Ref. 6 was revised and presented in Ref. 7. The same flow picture is used, and the theory proceeds as before save that the over pressure contributing to the interaction force is written as $\delta(dp)/(d\delta)$ instead of as $(p_{s2} - p_{s1})$. Values of the interaction to vacuum force ratios, F_i/F_v, calculated for two Mach numbers are shown in Fig. 4 for pressure ratios $P \equiv p_{j0}/p_{s1}$ ranging from 10 to 700. Force ratios calculated using the earlier method presented in Ref. 6 were 8% lower for $M_{s1} = 2.84$ and 15% lower for $M_{s1} = 3.90$. The theoretical results of Ref. 5 that are shown in Fig. 4 are in fair

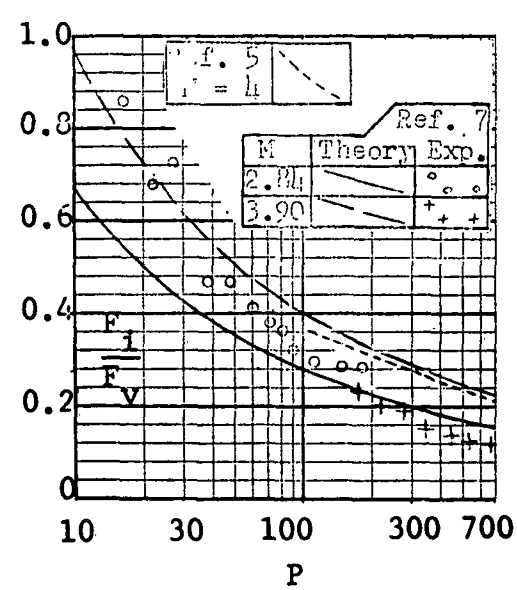

Fig. 4 - Theoretical and Experimental Interaction to Vacuum Force Ratios

agreement with those of Ref. 7; curiously enough, they are in better agreement with the theoretical results of Ref. 6.

The force measurements were made on ogive cylinders, with circular jet orifices located quite near their bases, in Mach 2.84 and Mach 3.90 flows. Unfortunately, technical difficulties led first to erroneous force data measurements being presented in Ref. 6. Corrected data presented in Ref. 7 are shown in Fig. 4. These tests were also the basis of the empirical data presented in Ref. 5.

The erroneous data presented in Ref. 6 indicated that the force ratio, F_i/F_v, increased with increasing M_{s1}, which agrees with theoretical conclusions drawn in both Refs. 5 and 6. Corrected data and conclusions drawn from the data in Ref. 7 indicate that the force ratio is independent of stream Mach number, as may be seen by study of the experimental data shown in Fig. 4. Indeed, a good empirical fit to the data may be obtained using (Ref. 7)

$$\frac{F_i}{F_v} = \frac{0.92}{\sqrt{PR}},$$

where R is the ratio of the jet orifice diameter divided by the diameter of the cylinder. It quickly becomes apparent that the above empirical relationship must only be valid for the limited models used in Ref. 7; the predicted force ratios would be absurdly large for small orifices or large diameter models, such as a flat plate. The two-dimensional theory does, however, correctly predict the trend of the force ratio (F_i/F_v increases as P decreases); this result is consistently indicated by the experimental data. Considering the strong three-dimensional nature of the tested interaction flow, it is fortuitous that even fair experimental corroboration was obtained. It was noted that the length of the forebody did not affect the interaction force; this was attributed to F_i being independent of the type of boundary layer: laminar or turbulent. Laminar boundary layer separation extends over a larger area but has lower pressures than in the smaller separated flow zone of turbulent boundary layer separation. As in the subsonic stream experiments, it was noted that the viscid interaction effects were negligible for the over-all force values; the induced pressures acted over a larger

area at slightly reduced values due to the presence of viscosity. The jet orifices tested were all close to the base of the bodies; in this way the decreased pressure downstream of the orifice only affected a small area. Any increase in afterbody length decreased F_i. The decrease in pressure behind the orifice is due to jet entrainment of the stream flow; the pressures are reduced below those existing before the start of the jet flow, and negative pressure coefficients are recorded.

The work reported on in Refs. 6 and 7 was extended and culminated in Ref. 8. Detailed isobar maps showing the low pressure zones behind the orifice were experimentally obtained for flow over a flat plate in which there is a circular jet orifice. The same two-dimensional theory was used but not the empirical relationship shown above on page 7. An empirical relationship for the interaction force is obtained in terms of the vacuum force, the pressure ratio, P, the diameter of the jet orifice, the total length of the plate, and the distance the orifice is behind the leading edge of the plate. The measured interaction forces are considerably larger for the plate than for the ogive cylinder because much of the over pressure on the cylinder is lost due to its curvature. Even for the three-dimensional jets tested, it was found that the interaction force in some cases exceeded the vacuum force of the jet.

Weak jets, that is, jets having reservoir pressures only a few times larger than the free stream static pressures and do not penetrate deeply the stream flow, were cursorily examined in Ref. 8. A flow picture was assumed "a priori" and, again, the final pressure was assumed equal to the free stream pressure. Although conclusions drawn from experimental evidence point out that weak jets can have high specific impulses and large interaction forces, a numerical example for $M_{s1} = 4$ and values of P below 1.4 indicated that $F_i = 0$ (Ref. 8).

Briefly summarizing, experiments have been performed and a few theories have been established to corroborate the results. The tests were limited to three-dimensional flows which preclude simple analyses. Theories, other than purely empirical relationships, were based on many, frequently obscure, assumptions and, moreover, fail to match well the available test data. The theories fail worsely for low pressure ratio values, the values for which the interference effects are most pronounced. Interaction forces, and hence over-all jet efficiencies, are greatest for weak

jets issuing from orifices of large effective diameters. Indeed, in lieu of the pressure drop behind strong three-dimensional jets, positive pressure coefficients are easily attainable downstream of weak two-dimensional jets.

Present Approach to Problem

The present approach to the problem starts with the given stream and jet reservoir conditions and determines the interaction flow streamline pattern. The possibility of various types of interaction flows is disclosed, and the number of necessary assumptions is minimized. A clearer understanding of the problem is thereby obtained. This gives rise to the possibility of beneficial use of substantial interaction forces.

Contrary to Refs. 6, 7, and 8, no assumption is made about the downstream pressure value; indeed, for weak jets, it is calculated and found to be considerably larger than the free stream pressure. Thus the two-dimensional flows emphasized in this report have positive pressure coefficients downstream of the orifices which lead to increased control forces rather than the decreased forces resulting from the negative pressure coefficients due to jet entrainment of the stream flow downstream of strong three-dimensional jets. The interaction forces may be several times larger than those shown in Fig. 4.

The analysis proceeds categorically to determine all of the possible types of interaction flows that can and will exist depending upon the given values of the parameters defining the problem which are: the stream conditions, the jet reservoir conditions, and the shape of the jet nozzle. Although viscid and three-dimensional effects are mentioned, in the bulk of the work both the jet and stream flows are assumed to be two-dimensional, and to obey the perfect gas law, inviscid compressible flow equations. It is further assumed that at least initially a slip surface (a slip line in the two-dimensional analysis) exists between the jet and stream flows, and therefore that the jet displaces the stream and is, in turn, affected by the displaced stream flow. The interaction flow is studied in more detail than in previous investigations.

The method of the present analysis may more clearly be outlined by referring to a typical type of interaction flow, such as the one sketched in Fig. 5. The jet flow may have any subsonic

or supersonic velocity at the orifice, unlike previous analyses which were restricted to choked jet flows at the orifice (Refs. 5 through 7), but the velocity must be uniform and perpendicular to the undisturbed stream flow. The jet flow is supersonic at the orifice for the particular case sketched in Fig. 5. The angle of the slip line at the upstream corner is such that there is an attached shock at the upstream corner in the jet flow, and the stream flow undergoes compression through a detached shock wave. The curvature of the slip line is qualitatively obtained by considering pressure variations along it for the jet and stream flows. By definition there can be no pressure difference across the slip line. It is tacitly assumed herein that the pressure varies monotonically along the slip line. Thus, for the example case shown in Fig. 5, the jet flow must expand behind the jet shock wave and therefore the slip line must curve upward at least until the expansion fan from the downstream corner meets the slip line and accounts for the expansion of the jet flow. The slip line then bends downstream until it becomes parallel to the undisturbed stream. The pressure in the jet flow along the slip line is monotonically decreasing as is the pressure in the stream flow along the slip line downstream of the stagnation point at the upstream corner. The final pressure reached is larger than the free stream pressure and so a downward force is exerted on the surface behind the orifice in lieu of the pressure drop experienced downstream of three-dimensional jets (Refs. 5 through 8). That the slip line must curve upward immediately behind the corner may also be seen by considering the reverse case of curving downward; in this case the jet pressure would increase whereas the stream pressure would decrease, obviously violating the condition of no pressure discontinuity across the slip line.

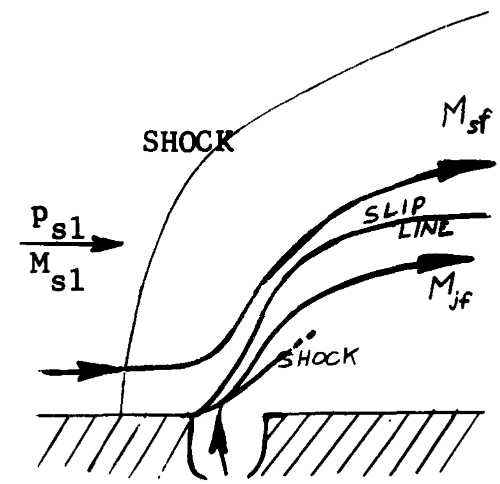

Fig. 5 - Sample Interaction Flow Model of Present Analysis

The assumption of monotonic pressure decrease along the slip line leads to far simpler analyses than if the pressure was al-

lowed to vary randomly. In actual flows of strong jets, such as shown in Fig. 5, the jet flow would probably separate at the downstream corner, and a separation bubble would exist. The jet flow would then attach to the wall surface downstream of the separation bubble and might undergo a compression, perhaps in the form of a shock wave. Thus, the jet flow would overexpand and would then have to compress. The stream flow would have to follow the same pressure variation along the slip line; a normal shock could exist in the stream flow. This case would require equal jet and stream Mach numbers since the pressure ratios across the normal shocks would have to be identical. Alternately, for unequal Mach numbers across the slip line, lambda shocks and compression regions would be expected. Consider, for example, a subsonic jet that overexpands and has a locally separated region. If the slip line curved back toward the wall and then curved upward to become parallel to the wall, a stream shock would occur. This shock would have to be matched by a sudden expansion of the subsonic jet flow. The analysis of such flows is prohibitively complicated at the present time; the monotonic pressure variation should still indicate qualitatively good results, particularly for the weak jets.

Separation might also occur in the stream flow ahead of the jet orifice, as depicted in Fig. 3. Further work is needed in the detail analysis in such contingencies. For weak jets giving rise to attached stream shocks, the stream flow will not separate prior to the jet orifice.

Even if no separation occurs, the flow is still complicated. The expansion of the jet flow at the downstream corner would lead to negative pressures and so it is to be expected that local compressions must occur. Even if the jet flow is subsonic at the orifice then expansion about the ninety degree corner would lead to a local region of supersonic flow bounded downstream by a lambda shock wave, similar to the supersonic bubble region existing on a body traveling transonically, just below the speed of sound. The interaction flow may well be tri-sonic (sub-, trans-, and super- sonic flow regions).

Several approaches to even the perfect fluid flow problem are apparent. Simple, straightforward, shock-expansion approaches are used in this report. Detailed analysis of any one particular type of interaction flow should be accomplished using the characteristics theory where applicable.

The stream flow over the slip line may be solved by using hypersonic blunt body theory for strong jets with detached shock waves or by using shock expansion theory for weak jets for which the stream shock is attached. The linear, second, and third order theories are not applicable in determining the final stream pressures since for all of them, it is necessary that $M_{s2}^2 \delta < 1$ which isn't satisfied by the flows considered herein. The problem is split into two separate flows and matching the pressures across the slip line, which may be regarded as a membrane.

The viscid effects discussed above are mentioned in more detail during the following analysis of each of the different types of flows. Three-dimensional and viscid effects are minimized for the weak jets considered herein. Real gas effects, particularly important for the hypersonic flows considered herein, may be incorporated in the results of any specific analysis. Their inclusion at the outset, however, would make intractable the problem of determining the different types of interaction effects possible and of predicting the conditions leading to any particular type of interaction flow. Real gas effects introduce additional variables, and any tabulation of types of flows would be increased by an order of magnitude and so become unwieldy.

Physically, the given parameters are the stream conditions, the jet reservoir conditions, and the shape of the jet. Under the assumptions of two-dimensional flows of compressible inviscid fluids obeying the ideal gas law and having constant specific heat ratios of seven-fifths, there are three meaningful variables that define the problem: the undisturbed stream Mach number, M_{s1}, the ratio of the jet reservoir pressure to the undisturbed stream static pressure, $P \equiv p_{j0}/p_{s1}$, and the so-called design jet Mach number, M_{jd}, which is the Mach number that would exist at the nozzle exit if the jet were exhausting into a vacuum. That these variables define the problem is partially shown by the determinancy of the problem of categorizing the types of interaction flows by using the variables listed above. The variables are used in the tables shown in the Appendix. The tables may be used to determine roughly the type of interaction flow that will prevail for given conditions and will enable comparing types of flows for optimum jet operating conditions in terms of maximum available induced control forces.

Evident in Fig. 4 of the preceding subsection is the increased control efficiency of very weak jets. In the present work attention is focused on weak jets which are two-dimensional in

nature. For two-dimensional analyses to be applicable, the jet orifice should be of fairly large aspect ratio, such as the slit type orifice which is recommended for use herein, in addition to the pressure ratio having a small value. The use of two-dimensional analyses is therefore more appropriate here than it was for the three-dimensional interaction flows studied in earlier analyses. Although strong jets are still treated, the emphasis is on weak jets leading to interaction flows which may be pictured to be similar to flows over surfaces which are film cooled. Indeed, it is particularly noted that weak, slit orifice, jets, in addition to yielding large interference forces and therefore being more efficient per unit of reaction fluid than strong jets, may also be used to film cool the surface downstream of the orifice. In Ref. 5, it is pointed out that weak jets would dangerously heat the surface in the downwash region of the jet. This effect is only true for the case considered therein of using hot exhaust gases as the reaction fluid (specific heat ratio γ of 1.20). The present analysis is for a compressible reaction jet gas having $\gamma = 1.40$. Upon expanding through the jet nozzle, the gas would be further cooled and would be much cooler than the boundary layer air over the vehicle. For the case of very weak jets, the interference force is similar to the problem of determining pressure fields associated with small mass addition to the flow (Ref. 9). The two-dimensionality depends on the width of the jet being several times larger than the penetration distance of the jet. Jets of circular or nearly circular cross section penetrate the stream and offer comparatively little induced force. Wide jets, on the other hand, influence a large portion of the surface and offer the possibility of large induced forces.

The analysis presented herein may be considered as a first approximation to indicate the magnitude of the interference effects. Other approaches have been found to be inapplicable in that they lead to erroneous results and hide essential features of the flow.

CLASSIFICATION OF INTERACTION FLOWS

The different types of interaction flows possible under the restriction of monotonically varying pressure along the slip line are classified according to sets of values of the pertinent parameters M_{jd}, M_{s1}, and $p_{j0}/p_{s1} \equiv P$ in this section. Given M_{jd} and M_{s1}, the type of interaction and, therefore, the appropriate flow model to be used, depends on the value of P. Thus, interaction flows are characterized by ranges of values of P; the values of P at the extremities of the ranges are used to distinguish one type of interaction flow from another and are tabulated in the Appendix. Equations for these values are obtained and presented in this section along with necessary subordinate calculation procedures and accuracies used in the tables. Compressible flow equations used in the numerical analyses are set forth. At first the jet stagnation (reservoir) pressure is taken as $p_{j0} = p_{s1}$ so that there is initially no jet flow; the stream flow is uniform over the flat surface in which the jet nozzle is embedded. The pressure ratio P is then increased and the different types of resulting interaction flows are classified for various M_{jd} and M_{s1} values. Definitions of the P values separating the different types of interaction flows, P_I through P_{VII}, are summarized in the table on page 31.

Compressible Flow Equations

The familiar equations presented here are those used most frequently in the numerical analyses in the following subsections. The equations, valid for perfect gas flows with $\gamma = 1.40$ (cf. Ref. 10), hold for both the stream and jet flows.

For isentropic expansion:

$$\frac{p_0}{p} = (1 + 0.2M^2)^{7/2}, \tag{1}$$

where subscript 0 refers to stagnation conditions. The ratio of stagnation pressures across a normal shock wave is given by

$$\frac{p_{10}}{p_{20}} = \left(\frac{M_1^2 + 5}{6M_1^2}\right)^{7/2} \left(\frac{7M_1^2 - 1}{6}\right)^{5/2} , \tag{2}$$

where subscript 1 refers to conditions in front of the shock and subscript 2 to conditions behind the shock. Another useful relation for normal shocks from Eqs. (1) and (2) is

$$\frac{p_{20}}{p_1} = (1.2M_1^2)^{7/2} \left(\frac{6}{7M_1^2 - 1}\right)^{5/2} . \tag{3}$$

For oblique shock waves

$$\frac{p_2}{p_1} \equiv \xi = \frac{7M_1^2 \sin^2 \theta - 1}{6} , \tag{4}$$

where ξ is the static pressure ratio across the shock and θ is the shock angle. The flow deflection angle δ for an oblique shock is given by

$$\tan^2 \delta = \frac{7M_1^2 - (6\xi + 1)}{6\xi + 1} \left[\frac{5(\xi - 1)}{7M_1^2 - 5(\xi - 1)}\right]^2 . \tag{5}$$

The Mach number immediately downstream of an oblique shock is given by

$$M_2^2 = \frac{(6\xi + 1)M_1^2 - 5(\xi^2 - 1)}{(6 + \xi)\xi} \tag{6}$$

or, solving Eq. (6) for the pressure ratio

$$\xi = \frac{3(M_1^2 - M_2^2) + \sqrt{[3(M_1^2 - M_2^2)]^2 + (M_1^2 + 5)(M_2^2 + 5)}}{M_2^2 + 5} \tag{7}$$

For a sonic oblique shock wave, that is, a shock for which $M_2 = 1$, the pressure ratio is

$$\xi_{M_2=1} = \tfrac{1}{2}(M_1^2 - 1) + \frac{1}{6}\sqrt{9M_1^4 - 12M_1^2 + 39} \, . \tag{8}$$

As noted in Refs. 10 and 11, no explicit oblique shock relations exist for the frequently encountered case of given M_1 and δ. The shock wave angle, and thence any other parameter, may be obtained by solving the following cubic for $G = 0$:

$$G = \sin^6\theta + g_1 \sin^4\theta + g_2 \sin^2\theta + g_3 \, , \tag{9}$$

where

$$g_1 = -\left(\frac{M_1^2 + 2}{M_1^2} + 1.4 \sin^2\delta\right)$$

$$g_2 = \frac{2M_1^2 + 1}{M_1^4} + \frac{1.44\, M_1^2 + 0.4}{M_1^2} \sin^2\delta$$

$$g_3 = -\frac{\cos^2\delta}{M_1^4} \, .$$

Because the smallest root of Eq. (9) for $G = 0$ indicates a decrease in entropy it has no physical meaning and should be disregarded. The largest root corresponds to the strong shock $(M_2 < 1)$ solution and is disregarded in this treatment. The weak shock solution is the middle root of Eq. (9) for $G = 0$ and is obtained in the following manner. Depending on the problem, a first guess is made for either the smallest or largest of the three roots, say $\sin^2 \phi$. Then G and its derivative, $dG/d(\sin^2 \theta) = 3 \sin^4 \theta + 2g_1 \sin^2 \theta + g_2$, are calculated. As a second guess for either the smallest or largest root,

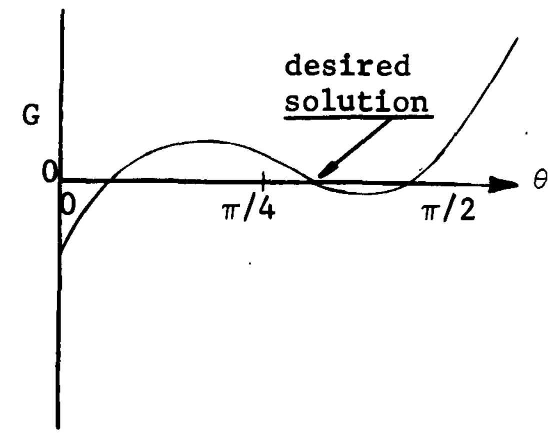

Fig. 6 - $G(\sin^2\theta)$

$$(\sin^2 \phi)_{new} = (\sin^2 \phi)_{old} - G\left(\frac{dG}{d(\sin^2 \theta)}\right)^{-1} .$$

The above steps are iterated until $\sin^2 \phi$ is found to the desired accuracy. The accuracy used for the tables was such that the iteration ceased once

$$\left|\frac{(\sin^2 \phi)_{new} - (\sin^2 \phi)_{old}}{(\sin^2 \phi)_{old}}\right| < 4 \cdot 10^{-6}$$

so five figure accuracy for $\sin^2 \phi$ was obtained. The shock wave angle is then given by

$$\sin^2 \theta = -\tfrac{1}{2}(g_1 + \sin^2 \phi)$$

$$\pm \sqrt{[0.25(g_1 + \sin^2 \phi) - \sin^2 \phi](g_1 + \sin^2 \phi) - g_2} .$$

The plus sign is used when $\sin^2 \phi$ is the largest of the three roots; the minus sign is applicable if $\sin^2 \phi$ is the smallest root.

The parameters in the above equations and iteration scheme appear without the subscripts s and j (referring to the stream and jet flows respectively). Either subscript may be used consistently in any of the equations since they are valid for both the stream and jet flows. Thus, for isentropic expansion in the jet flow from the reservoir pressure to a pressure p_{j1}, from Eq. (1), $p_{j0} = p_{j1}(1 + 0.2\, M_{j1}^2)^{7/2}$; for isentropic expansion in the stream flow from the pressure behind an attached shock to the final pressure p_{sf}, also from Eq. (1), $p_{s20} = p_{sf}(1 + 0.2\, M_{sf}^2)^{7/2}$.

Choked Jet Nozzles

In lieu of considering simply choked jet nozzles as done previously (Refs. 2 through 7), a more general nozzle shape is allowed here. A throat, which may be the throatling valve, is allowed to exist so that the jet flow may expand supersonically; it is only required that the nozzle walls be perpendicular to the undisturbed stream at the surface. The pertinent shape factor for this case is the ratio of the jet nozzle throat to exit areas, A_*/A_e, which is a function of only the design jet Mach number (Ref. 10):

$$\frac{A_*}{A_e} = M_{jd}\left(\frac{6}{5 + M_{jd}^2}\right)^3 \qquad (10)$$

M_{jd} is taken as the nozzle shape parameter. The nozzle need not be two-dimensional; indeed, the two-dimensional theory used herein for the interaction flow would be a better approximation if the nozzle expanded transversely to the stream, as sketched in Fig. 7, rather than if the expansion occurred parallel to the stream flow. The larger the aspect ratio of the orifice, the better the two-dimensional approach becomes.

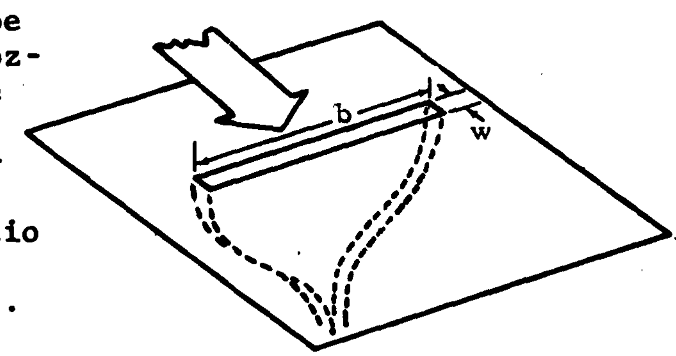

Fig. 7 - High Aspect Ratio Jet Nozzle Orifice

Supersonic jet flow in the nozzle may or may not occur, depending on the values of M_{jd},

M_{s1}, and P. Although the jet flow will start as long as $P > 1$, it may remain subsonic throughout the nozzle. In determining whether or not the nozzle is choked, it is sufficient to determine if the jet flow is restricted at some exterior point more than it is at the nozzle throat. This "choking" condition is much more severe than the ordinary wind tunnel choking condition. A wind tunnel flow must be supersonic at the nozzle exit; if a normal shock occurs in the nozzle, the flow is considered choked. The ratio of the tunnel diffuser and nozzle throat areas must exceed the total pressure ratio across a normal shock at M_{jd} to avoid normal shocks in the nozzle with the attendant subsonic flow at the nozzle exit (Ref. 12). The condition used herein of a restriction in the external jet flow to an area equal to the nozzle throat area prohibits the internal jet flow from being supersonic anywhere; no shocks can exist in the nozzle.

As the value of P increases from unity, the jet flow starts and an interface between the stream and jet flows, referred to as the slip line, moves outward from the surface to allow for the jet flow, as shown in Fig. 8. For weak jets, values of $P > 1$, the

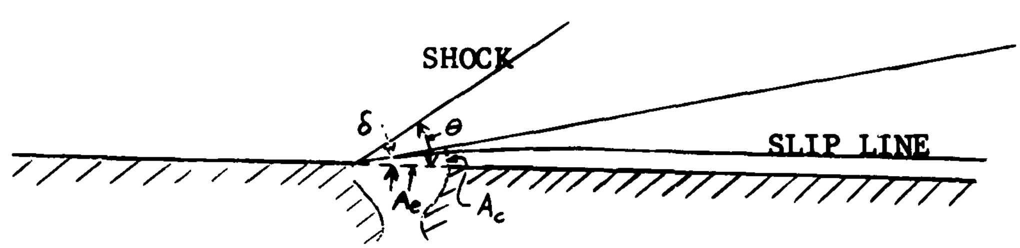

Fig. 8 - Choked Jet Nozzle Flow

initial angle, δ, of the slip line is quite small. At least in the region of the jet orifice, particularly for high aspect ratio, slit type orifices, the tangent to the slip line at the upstream corner remains fairly close to the slip line. The minimum area section of the external jet flow, A_c, is almost coincident with the perpendicular from the downstream corner to the tangent to

the slip line. The depth of the jet flow at the downstream corner is taken to be the depth (i.e., span b) of the jet orifice. The spreading of the jet flow tends to compensate for the difference in height above the downstream corner of the slip line and its tangent in estimating A_c. The pressure decrease in the jet flow from the upstream corner to A_c must be compensated for by an equal decrease in the stream flow pressure on the other side of the slip line. The decrease in the stream pressure is accomplished through Prandtl-Meyer expansion which necessitates the slip line curving below the tangent. Flow separation is not expected in the stream upstream of the orifice for these weak jet, film cooling type flows. Inviscid subsonic flow around the sharp downstream corner theoretically leads to the existence of a local supersonic region bounded by a sonic curve perpendicular to the nozzle wall at the corner and meeting a lambda type shock just downstream of the corner. Such regions would probably not be observed experimentally due to viscid effects; this question is discussed further in the section entitled Conclusions and Recommendations.

With depth of the jet flow at A_c equalling the depth of the orifice, it follows geometrically and from the above that

$$\sin \delta = \frac{A_c}{A_e} . \tag{11}$$

From the preceding paragraphs, for external choking so that the entire nozzle flow is subsonic, $A_c = A_*$. Combining this with Eqs. (10) and (11),

$$\sin \delta = M_{jd}\left(\frac{6}{5 + M_{jd}^2} \right)^3 \tag{12}$$

for choked jet flows. The pressure ratio P, below which the flow is choked and the nozzle will not start, is referred to as P_I.

The value of P_I, for given M_{jd} and M_{s1}, is found in the following manner. Since the jet flow is choked, the pressure at the upstream corner is the stagnation pressure of the subsonic jet flow, P_{j0} (Ref. 14). This pressure must equal the stream

pressure just behind the attached shock wave at the slip line since the slip line cannot support a pressure difference. Thus, for choked flows,

$$P_I = \frac{p_{j0}}{p_{s1}} = \frac{p_{j0}}{p_{s2}} \cdot \frac{p_{s2}}{p_{s1}} = \frac{p_{s2}}{p_{s1}} = \xi \ . \tag{13}$$

The value of ξ, the pressure ratio across the attached shock, must be found for the given M_{jd} and M_{s1} values. The flow deflection angle for choking for M_{jd} is given by Eq. (12). The iteration scheme using Eq. (9), page 16, is used to obtain the shock wave angle for the flow deflection angle δ and for the upstream Mach number $M_1 = M_{s1}$. Due to the expected smallness of δ, it was most efficient to determine first the largest root of Eq. (9); $\sin^2 \phi = 1.0$ was used to start the iteration. The value of ξ, and hence P_I, follows from Eqs. (4) and (13) once $\sin^2 \theta$ is obtained.

For pressure ratios less than P_I subsonic flow exists throughout the nozzle and the reservoir, stagnation, pressure exists at the upstream corner. Higher pressure ratios indicate that supersonic nozzle flow can start and hence that normal shocks may occur in the divergent part of the nozzle. The jet stagnation pressure would thereby be reduced along with the stream flow deflection angle, and as indicated in the following section, the efficiency of the jet as a control device would be decreased.

The above choking criteria apply only for attached stream shocks such that $M_{s2} > 1$. The case of detached shock waves is discussed in a later subsection. The theoretical maximum flow deflection angle, for which the shock wave can be attached and $M_{s2} = 1$, is attained for infinite upstream Mach number and, from Eq. (5), is given by $\sin \delta = 5/7$. Using this value in Eq. (12), it follows that for all $M_{jd} < 1.763$ the jet flow will always be choked for all stream flows with attached shocks. For these cases it is unnecessary to consider the possible existence of normal shocks in the nozzle with their attendant jet pressure losses.

Sonic Jet Flow

The exterior jet flow may expand downstream and become supersonic whether or not it is choked and is subsonic throughout the

nozzle. The pressure along the slip line decreases monotonically to some final value, say $p_{sf} = p_{jf}$, at which point, for jet flow continuity, the slip line becomes parallel to the surface. Inviscidly, the jet and stream flows then continue with constant flow properties. Viscidly, the mixing of the jet and stream flows will occur more rapidly if the jet flow is subsonic rather than supersonic. The final jet flow will be sonic if

$$\frac{p_{jf}}{p_{je}} = 0.5283 \,, \tag{14}$$

where p_{je} is the jet flow pressure at the start of the slip line. The corresponding value of P is referred to as P_{II} and is given by:

$$P_{II} = \frac{p_{j0}}{p_{s1}} = \frac{p_{j0}}{p_{je}} \cdot \frac{p_{je}}{p_{s2}} \cdot \frac{p_{s2}}{p_{s1}} \quad . \tag{15}$$

Because the slip line does not support a pressure difference, $p_{je} = p_{s2}$ and $p_{jf} = p_{sf}$. Thus, from Eq. (14),

$$\frac{p_{sf}}{p_{s2}} = 0.5283 \,.$$

In lieu of using an iteration scheme which would be required to find P_{II} for given M_{jd} and M_{s1}, an inverse scheme is used. A value is chosen for M_{s2} and then the corresponding value of M_{s1} is calculated:

1. Pick M_{s2}.
2. Find p_{s2}/p_{s20} and the Prandtl-Meyer angle ν_2 corresponding to M_{s2} from tables such as those in Ref. 10.

3. Calculate

$$\frac{p_{sf}}{p_{s20}} = \frac{p_{sf}}{p_{s2}} \cdot \frac{p_{s2}}{p_{s20}} = 0.5283\ \frac{p_{s2}}{p_{s20}}\ .$$

4. Find the final Prandtl-Meyer angle ν_f corresponding to the value of p_{sf}/p_{s20} from tables (e.g., Ref. 10).

5. The total expansion angle of the stream is $\Delta\nu = \nu_f - \nu_2$.

6. The deflection angle must equal the expansion angle, $\delta = \Delta\nu$.

7. Find M_{s1} and ξ corresponding to M_{s2} and δ from tables (e.g., Ref. 11), or else by solving Eqs. (5) and (7) iteratively.

Thus, there remains only the calculation of p_{j0}/p_{je} for the evaluation of P_{II} from Eq. (15), ($p_{je} = p_{s2}$ and $p_{s2}/p_{s1} = \xi$ is known from step 7 of the above calculation scheme). If the jet nozzle is choked, then $p_{je} = p_{j0}$; the subsonic jet flow stagnates at the upstream corner. If the nozzle is not choked, then large pressure losses may occur, depending on the design jet Mach number. As the jet reservoir pressure is increased, the slip line is forced further away from the surface, the initial angle increasing with $p_{s2} = p_{j0}$, until the jet flow becomes sonic at the nozzle throat. Because the slip line tends to remain as close as possible to the surface, further increases in jet reservoir pressures are compensated by a normal shock in the nozzle close to the throat, the slip line angle remaining constant. The largest the pressure loss could be is across a normal shock near the nozzle exit. The minimum pressure ratio above which the jet flow must become sonic is that of the stagnation pressures across a normal shock with upstream Mach number M_{jd} [given by Eq. (2)].

Sonic Stream Shock

As the jet pressure increases, the slip line moves outward; the initial stream deflection angle increases, and M_{s2} de-

creases to unity. Further pressure increases cause the stream shock to curve significantly and necessitate other than Prandtl-Meyer expansion flow analysis in the expansion region downstream of the shock. Three cases now arise: The jet nozzle may be choked; there may be normal shocks in the jet nozzle; or there may be a shock in the jet flow attached at the upstream corner, as sketched in Fig. 9. The three cases are considered separately in arriving at the maximum pressure ratio, P_{III}, for which the stream shock will be sonic.

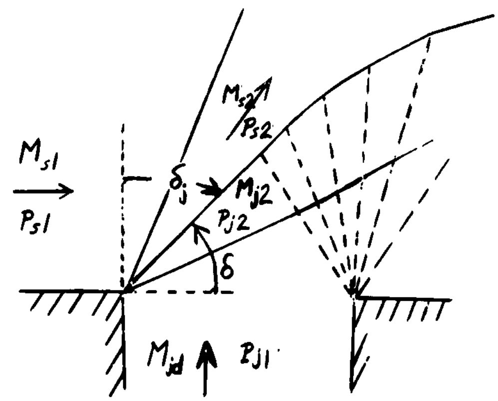

Fig. 9 - Flow for Both Stream and Jet Attached Shocks

If the nozzle is choked, then the jet pressure at the upstream corner is p_{j0} which must be equal to p_{s2}. Thus, for sonic stream shocks $(M_{s2} = 1)$,

$$P_{III} = \left(\frac{p_{j0}}{p_{s1}}\right)_{M_{s2}=1} = \frac{p_{j0}}{p_{s2}}\left(\frac{p_{s2}}{p_{s1}}\right)_{M_{s2}=1} = (\xi)_{M_{s2}=1} , \tag{16}$$

which is a function of only M_{s1} given by Eq. (8).

If the nozzle is in flow, (i.e., if the nozzle "starts" and the jet flow is supersonic downstream of the nozzle throat), then for maximum pressure losses,

$$P_{III} = \frac{p_{j0}}{p_{j20}} \cdot \frac{p_{j20}}{p_{s2}} (\xi)_{M_{s2}=1} . \tag{17}$$

The first factor is given by Eq. (2); the second factor is unity, and the third factor is given by Eq. (8).

The third alternate of two attached shocks, sketched in Fig. 9, is possible only for large enough values of both M_{jd} and M_{s1} indicated in Fig. 10. For the sets of Mach number values below the curve, the stream shock bends and detaches before a jet shock can attach at the upstream corner. In the region above the curve, it is theoretically possible, as the jet reservoir pressure is increased, for the jet shock to move out of the nozzle and become an oblique shock attached at the start of the slip line before the stream shock bends and detaches. The initial slip line angle is within the range 45 ± 1 degree; if the angle between the upstream nozzle wall and surface is greater than 92 degrees, then both shocks can not be attached simultaneously. Real gas effects, important particularly for large Mach numbers and strong shocks such as those required for this case, slightly increase the downstream pressure and make more dubious the existence of this theoretical case. Still, for large M_{jd} and M_{s1} values, there must be a transition region between attached stream shocks and attached jet shocks; the forces acting on the surface during this transition may best be estimated by considering this theoretical model until experimental results are available.

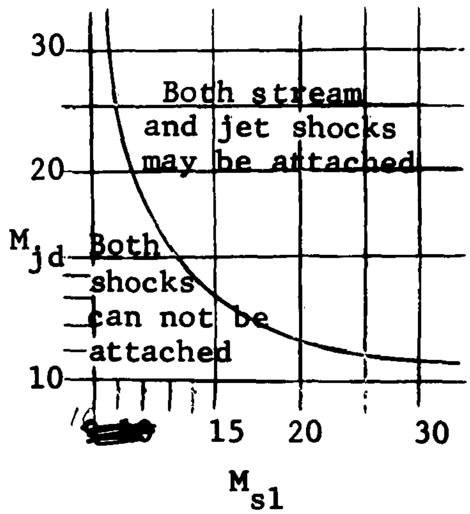

Fig. 10 - Mach Numbers for Which Stream and Jet Shocks May Both Be Attached

For two attached shocks, as shown in Fig. 9, and for $M_{s2} = 1$:

$$P_{III} = \frac{p_{j0}}{p_{j1}} \cdot \frac{p_{j1}}{p_{j2}} \cdot \frac{p_{j2}}{p_{s2}} (\xi)_{M_{s2}=1} \quad . \tag{18}$$

As above, the fourth factor in Eq. (18) is obtained using Eq. (8), page 16. Because of pressure equality across the slip line, the third factor is unity. The stream flow deflection angle δ is obtained using Eq. (5); its complement, the jet flow deflection angle δ_j, is $\delta_j = 90° - \delta$. Knowing δ_j and M_{jd}, (p_{j2}/p_{j1}) may be found from the tables in Ref. 11 or else may be calculated using Eq. (4) once the jet shock angle has been determined. An iteration process, such as the one on page 16, must be used if the jet shock angle is to be calculated. Because of the largeness of δ_j and M_{jd}, one root of Eq. (3) must be quite small. Concentrating on the smallest root, a first guess for the iteration is simply $\sin^2 \phi = 0$. Once (p_{j2}/p_{j1}) is known, its inverse, which is the second factor in Eq. (18), may be calculated. The first factor in the equation is given by Eq. (1), page 14, for isentropic expansion to M_{jd}.

Strong Stream Shock

At higher values of P, the pressure behind the stream shock is increased (equalizing the increased pressure in the jet flow at the start of the slip line); the stream flow immediately behind the strong shock becomes subsonic; the shock becomes curved and finally becomes normal at the wall and detaches. Such a flow for an $M_{jd} = 1.0$ nozzle is sketched in Fig. 11. The stream flow deflection angle δ remains essentially constant as the shock changes from sonic to normal at the wall; the fractional degree change in δ is beyond the accuracy of this theoretical development. As before, there are the three cases: choked jet nozzle, normal shocks in nozzle, or an attached jet shock at the start of the slip line. For all three cases the stream stagnates at the start of the slip line. The pressure ratio above which the stream shock will always be normal to the wall is referred to as P_{IV}.

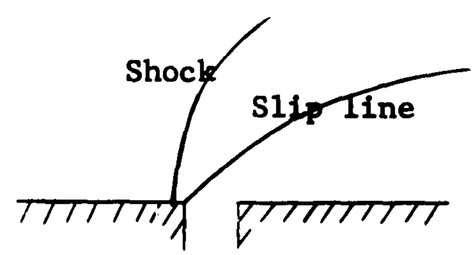

Fig. 11 - Strong Stream Shock for M_{jd} = 1.0 Nozzle

If the jet nozzle is choked,

$$P_{IV} = \frac{p_{j0}}{p_{s20}} \cdot \frac{p_{s20}}{p_{s1}} \ . \tag{19}$$

The first factor is unity because of pressure equalization across the slip line. The second factor is given by Eq. (3), page 15.

If there are normal shocks in the jet nozzle flow,

$$P_{IV} = \frac{p_{j0}}{p_{j20}} \cdot \frac{p_{j20}}{p_{s20}} \cdot \frac{p_{s20}}{p_{s1}} \ . \tag{20}$$

For maximum jet pressure losses, the first factor is given by Eq. (2) for a normal shock at M_{jd}. The second factor is unity, and the third factor is given by Eq. (3).

If there is a shock attached at the start of the slip line in the jet flow,

$$P_{IV} = \frac{p_{j0}}{p_{j1}} \cdot \frac{p_{j1}}{p_{j2}} \cdot \frac{p_{j2}}{p_{s20}} \cdot \frac{p_{s20}}{p_{s1}} \ . \tag{21}$$

The first factor may be calculated using Eq. (1), page 14, for isentropic expansion to M_{jd}. As noted in the first paragraph of this subsection, the flow deflection angle δ is the same as for a sonic stream shock, well within the accuracy of this report. Hence, δ_j and then (p_{j1}/p_{j2}) are determined in the same manner as they are for Eq. (18), page 25. The third factor in Eq. (21) is unity, and the fourth factor may be calculated using Eq. (3), page 15.

Strong Jet Shock

Another limiting condition, apparent in some of the preceding subsections, is that of the strongest shock wave possible in the jet flow: a normal shock wave just upstream of the nozzle

exit. Maximum jet pressure losses occur for this condition which corresponds to a value of P referred to as P_V. At all lower pressure ratios, the jet shock, if one exists, is further upstream of the nozzle exit. At all higher pressure ratios there is a jet shock attached at the upstream corner. Thus, as the pressure ratio increases, a normal shock in the jet nozzle moves downstream until it attaches at the slip line. Similarly to stream deflection angles being essentially equal for the sonic and strong stream shock cases, the jet flow deflection angle at the slip line is essentially equal to the angle for which the jet shock would be sonic at the slip line. Just two cases arise in this instance: detached and attached stream shocks.

If the stream shock is detached,

$$P_V = \frac{p_{j0}}{p_{j20}} \cdot \frac{p_{j20}}{p_{s20}} \cdot \frac{p_{s20}}{p_{s1}} \quad . \tag{22}$$

The first factor is given by Eq. (2), page 15, for a normal shock at M_{jd} with upstream stagnation pressure equal to p_{j0}. Equal pressures across the slip line at its start make the second factor unity. The third factor may be calculated using Eq. (3).

If the stream shock is attached,

$$P_V = \frac{p_{j0}}{p_{j20}} \cdot \frac{p_{j20}}{p_{s2}} \cdot \frac{p_{s2}}{p_{s1}} \quad . \tag{23}$$

Again, the first factor is given by Eq. (2), and the second factor is unity. The jet flow deflection angle δ_j must be determined in order to calculate the third factor in Eq. (23). As noted above, δ_j is considered invariant in this treatment as the jet shock curves and becomes sonic. Thus δ_j is determined by using Eq. (5), page 15, for upstream Mach number equal to M_{jd} and for a pressure ratio $(\xi_j)_{M_{j2}=1}$ given by Eq. (8). The stream flow deflection angle is $\delta = 90° - \delta_j$. Tables, such as those in Ref. 11, are then used to obtain (p_{s2}/p_{s1}) corresponding to the values of δ and M_{s1}.

Sonic Jet Shock

As the pressure ratio increases, the normal jet shock at the nozzle exit attaches at the start of the slip line, bends, and then becomes a sonic shock. For pressure ratios higher than P_{VI}, the jet flow is supersonic everywhere (downstream of the nozzle throat), and so is amenable to solutions using purely supersonic methods. The stream shock may be either detached or attached.

If the stream shock is detached,

$$P_{VI} = \frac{p_{j0}}{p_{j1}} \cdot \frac{p_{j1}}{p_{j2}} \cdot \frac{p_{j2}}{p_{s20}} \cdot \frac{p_{s20}}{p_{s1}} \ . \tag{24}$$

For sonic jet shocks $M_{j2} = 1.0$ and ξ_j, a function of only M_{jd}, is given by Eq. (8), page 16. Thus, the first factor in Eq. (24) may be obtained from Eq. (1) for isentropic expansion to M_{jd} and the second factor is just the reciprocal of ξ_j. The third factor is unity, and the fourth factor may be obtained from Eq. (3).

If the stream shock is attached,

$$P_{VI} = \frac{p_{j0}}{p_{j1}} \cdot \frac{p_{j1}}{p_{j2}} \cdot \frac{p_{j2}}{p_{s2}} \cdot \frac{p_{s2}}{p_{s1}} \ . \tag{25}$$

The first two factors in Eq. (25) may be obtained in the same manner as for Eq. (24). The third factor is unity because the slip line cannot support a pressure difference. Knowing ξ_j and M_{jd}, Eq. (5), page 15, may be solved for δ_j. The stream flow deflection angle is $\delta = 90° - \delta_j$. Tables, such as those in Ref. 11, may then be used to obtain the fourth factor in Eq. (25) corresponding to the values of M_{s1} and δ.

Strong Jet

As the pressure ratio increases still further, the slip line moves outward and becomes normal to the wall; the stream deflection

angle is 90 degrees and the flow resenbles the strong jets described in the preceding sections. Viscid and three-dimensional effects are most important for this case. Separation will occur in the stream flow ahead of the jet and also in the jet flow at the downstream corner of the nozzle. The jet will penetrate the fluid rather than purely pushing it away from the surface. The pressure ratio P_{VII} required for the slip line to be perpendicular to the wall may only be roughly calculated using the inviscid analysis:

$$P_{VII} = \frac{p_{j0}}{p_{j1}} \cdot \frac{p_{j1}}{p_{s20}} \cdot \frac{p_{s20}}{p_{s1}} . \tag{26}$$

The first factor is given by Eq. (1), page 14, for isentropic expansion to M_{jd}. For $\delta = 90°$ there is neither jet flow compression nor expansion at the upstream corner so the jet pressure is just p_{j1} which must equal the stagnated stream pressure p_{s20}. Thus, the second factor in Eq. (26) is unity. The last factor may be obtained using Eq. (3).

Definitions of the pressure ratios P_I through P_{VII} are presented on page 31. Values of P for the seven limiting cases are tabulated versus M_{s1} in the Appendix for 22 values of M_{jd}. The various flow conditions in the regions bounded by the limit curves are graphed and described in the following section for sample cases. In several instances, some limit curves are coincident, but the flow regions neither overlap, which would indicate indeterminacy and nonuniqueness of the solution, nor leave voids, which would indicate no stable solutions, in the plots. Sample force calculations are also given in the following section.

SUMMARY OF SOME DEFINITIONS FOR THE PRESSURE RATIOS P_I THROUGH P_{VII}

WEAK JETS	P_I	Choked jet nozzle	For all $P < P_I$, the jet nozzle is choked and the flow everywhere in the nozzle is subsonic.
	P_{II}	Sonic jet flow	For all $P > P_{II}$, the final (external) jet flow is supersonic.
	P_{III}	Sonic stream shock	For all $P < P_{III}$, there is an oblique shock wave in the stream flow attached at the start of the slip line; the stream flow is supersonic everywhere.
	P_{IV}	Strong stream shock	For all $P > P_{IV}$, the stream shock wave is detached from the slip line and is normal to the wall.
STRONG JETS	P_V	Strong jet shock	For all $P < P_V$, the jet flow is subsonic at the nozzle exit; normal shocks exist in the nozzle if the jet flow is sonic at the nozzle throat.
	P_{VI}	Sonic jet shock	For all $P > P_{VI}$, the jet flow is supersonic everywhere downstream of the nozzle throat.
	P_{VII}	Strong jet	For all $P > P_{VII}$, the jet flow expands upstream upon leaving the nozzle.

FLOW REGIMES AND FORCES

Reaction jet efficiency as a control device depends upon the sum of the Newtonian reaction force and the additional force exerted on the surface due to the interaction of the jet and stream flows. Interaction forces and procedures for calculating them vary greatly for the different types of interaction flows which are uniquely determined by sets of values of M_{jd}, M_{s1}, and P. The different types possible for a given value of M_{jd} may be associated with the regions bounded by the P_I through P_{VII} curves in a P versus M_{s1} diagram. Values of the limiting pressure ratios are plotted versus M_{s1} for four representative jet nozzles (M_{jd} values of 1, 5, 12, and 30). The type of interaction flow characteristic of each flow regime ($P - M_{s1}$ region) is described by referring to the four sample plots, even though the salient features for $M_{jd} > 12$ flows may only be of academic interest. A qualitative comparison is made of the various control forces available, and sample forces are calculated.

Jet Reaction Forces

The Newtonian reaction force of a jet exhausting into ambient air at pressure p_a may be written as

$$F_a = (\rho_e V_e A_e) V_a \ , \tag{27}$$

where ρ is the jet flow density, V is the velocity, A is the jet flow cross-sectional area, subscript a refers to conditions when the jet flow pressure has expanded to the ambient pressure, and subscript e refers to conditions at the jet nozzle exit. The term inside the parentheses is the weight efflux W of the jet flow and the specific impulse of the jet, a measure of its efficiency, is: $I_a = F_a/W$. By continuity and momentum considerations, the final jet velocity is (Ref. 13)

$$V_a = V_e + \frac{p_e - p_a}{\rho_e V_e} \ . \tag{28}$$

Combining Eqs. (27) and (28), using the perfect gas relationship $\rho V^2 = \gamma p M^2$, and setting $\gamma = 1.40$ yields

$$F_a = \left[(1 + 1.4 M_e^2) p_e - p_a \right] A_e \; . \tag{29}$$

The reaction force is a function of M_e, p_e, and p_a; these flow parameters are strongly affected by the interaction of the jet and stream flows. Thus, the reaction force cannot be calculated until the interaction flow is analyzed. There are, however, two hypothetical values of the reaction force that may be calculated and used for the purpose of comparison. The hypotheses are that the exit conditions are the design conditions of the jet nozzle and that the external pressure at the nozzle exit is either zero or equal to p_{sl}. The reaction force for exhaustion into a vacuum is, using Eqs. (1) and (29),

$$F_v = \frac{1 + 1.4 M_{jd}^2}{(1 + 0.2 M_{jd}^2)^{7/2}} p_{j0} A_e = \left(\frac{5}{6}\right)^3 \frac{1 + 1.4 M_{jd}^2}{M_{jd} \sqrt{1 + 0.2 M_{jd}^2}} p_{j0} A_* \; , \tag{30}$$

where Eq. (10), page 18, was used in relating A_e and A_*. The reaction force for exhaustion into ambient air at pressure $p_a = p_{sl}$ is, using Eqs. (1) and (29),

$$F_a = \left[\frac{1 + 1.4 M_{jd}^2}{(1 + 0.2 M_{jd}^2)^{7/2}} p_{j0} - p_{sl} \right] A_e = F_v - p_{sl} A_e \; . \tag{31}$$

The vacuum reaction force for sonic nozzles, given by Eq. (30) with $M_{jd} = 1.0$ and $A_e = A_*$, is used for comparison purposes in Refs. (6) and (7).

The hypothetical reaction forces given in Eqs. (30) and (31) are maximum values, upper limits on the values of the reaction forces that would occur in interacting stream and jet flows. It is known that the final pressure of the jet must equal the final stream pressure, p_{sf}, but this occurs after the jet has been bent downstream and is parallel to the wall. The force value will be between the values given by expansion to p_{sf} and by no expansion (in which case p_e is the final pressure). The evaluation of p_e is also a problem because of its variance from the upstream corner to the downstream corner across the width of the jet. If M_e is subsonic, then the flow stagnates at the upstream corner but expands at the downstream corner. Eqs. (30) and (31) exaggerate the values of the reaction forces particularly for weak jets for which the static pressure outside the nozzle exit will exceed p_a and for which there usually will be shock pressure losses in the jet nozzle. Thus, the importance of the interaction forces are underestimated by comparing them with the reaction forces F_a or, even more so, with F_v.

Interaction Forces

The interaction forces are those due to pressure variations over the surface from which the jet issues. The pressure may either increase or decrease because of the interaction flow. Thus, for a strong three-dimensional jet of the type sketched in Fig. 1, the surface pressure will be increased upstream of the jet orifice in the region behind the detached stream shock but will be decreased downstream of the orifice (Ref. 8). For weaker, two-dimensional jets, increased surface pressures are expected both upstream and downstream of the orifice. The increased pressure upstream is due to the increased boundary layer thickness (as shown in Fig. 3) and the pressure jump across the stream shock (Refs. 5 and 8). The increased pressure downstream of the orifice may be predicted on theoretical grounds for weak jets and is the prime subject of this report.

The two-dimensional jet displaces the stream flow away from the surface. The stream flow is first compressed. It then expands until the slip line becomes parallel to the surface. The pressure acting along the slip line is assumed to be imposed on the surface (i.e.: the pressure is assumed constant across the jet downstream of the orifice).

Deflections of supersonic streams resulting in nonisentropic compressions of the fluid increase the pressure more than equal angle expansions decrease it; thus, the pressure on the slip line is greater than the free stream pressure. This pressure rise is imposed on the surface aft of the orifice and produces a force in the same direction as the reaction force. The effect becomes more pronounced as the stream Mach number is increased. Even for two-dimensional jets of moderate strength, having detached stream shocks, there is a large pressure rise along the streamline. These effects are obviously important in the blunt leading edge phenomena peculiar to hypersonic flows. A little blunting causes the pressure to far exceed its free stream value. The decay in the pressure on the surface parallel to the free stream is particularly gradual for hypersonic streams because of the extreme slope of the expansion waves reflected from the shock wave. The inviscid pressure rise is independent of the height of the step and thus of the size of the jet mass flow. Including viscid effects, the pressure rise persists for very many step-height distances downstream. Hence, positioning a two-dimensional jet near a leading edge would increase the pressure acting on the entire surface downstream of the jet. On the other hand, by first expanding the stream and then shocking it through an equal angle, the pressure is greatly reduced. Thus, using the shock expansion theory for a free stream flow with $M_{s1} = 7.0$ and pressure p_{s1} (Fig. 12) the final pressure is twice the value of p_{s1} if the

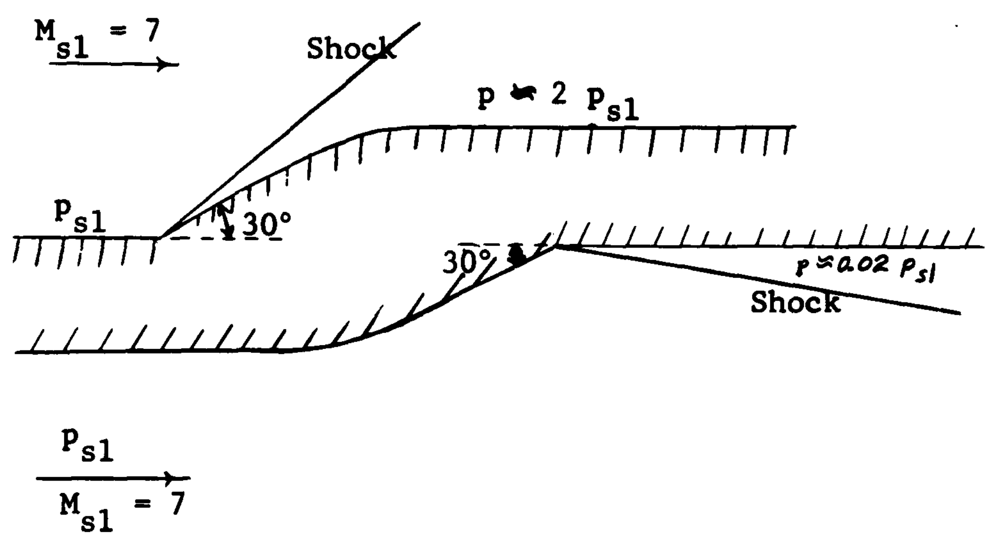

Fig. 12 - Comparison of Shock Expansion Flows

flow is first compressed and then expanded through 30 degrees; the final pressure is one-fiftieth the value of the free stream pressure if the flow is first expanded and then compressed through 30 degrees (Refs. 10 and 11).

Pressures along the slip lines for interaction flows having attached stream shocks may be calculated using the shock expansion theory. The initial flow deflection angle is calculated for jet and stream pressure equalization at the start of the slip line. The flow conditions downstream of the shock are found for the free stream conditions and flow deflection angle (Ref. 11). Prandtl-Meyer expansion is then used until the slip line is parallel to the surface ($\Delta\nu = \delta$). Linear, second, and third order small perturbation theories were used to obtain explicit relations for ν, thereby avoiding the necessity of using tables, but even the third order theory fails and fails badly (negative values of p_{sf}/p_{s2} were indicated) unless $M_2^2\delta < 1$ (which is not satisfied for these cases). Interaction forces are obtained by integrating the pressures, calculated using the shock expansion theory, over the surface.

Flow regimes for which the stream shock is detached pose a more complicated problem. The initial flow deflection angle must be determined by analysis of both jet and stream flows. The stream flow stagnates at the start of the slip line, and the pressure then decreases monotonically until the slip line is parallel to the surface. The modified Newtonian impact theory may be used in conjunction with the shock expansion theory to determine pressures along slip lines (Refs. 14 and 15). The stream pressure drop from its stagnation value at the start of the slip line is taken proportionally to the sine square law up to the point where the slope of the pressure curve matches that obtained by using Prandtl-Meyer expansion.

The detailed shape of the slip line may require matching pressure variations along the slip line for supersonic and subsonic flows. For example, the external jet flow may be subsonic whether or not the stream shock is detached. The jet flow at the start of the slip line, being subsonic flow in an interior corner, may be represented as potential flow and solved using a transformation. The pressure variation along the slip line must match that obtained from supersonic theory for the stream flow.

The over-pressure downstream of the orifice may also be calculated using blast wave theory (Refs. 16 and 17). Although this

theory shows the gradual decay of the over-pressure, it is not strictly applicable to flows over blunt bodies with small curvature (such as the slip line shape for detached stream shocks). The height of the step is large enough so that either the body length would be exceeded or three-dimensional effects would predominate before there was significant decrease in the over-pressure.

Interaction forces are again obtained by integrating the over-pressures over the surface. For detached shocks, the shock stand-off distance must be calculated and the additional force due to the increased pressure between the shock and the jet orifice must be included (Refs. 5 through 8). Boundary layer separation probably will occur before the jet, as before a step, and streamline the effective body shape. The pressure distribution would be strongly affected; viscid effects should be considered in arriving at the effective body shape (Ref. 8). Forces obtained by pressure integrations are shown in examples in the subsection entitled Sample Force Calculations.

The interaction force results from the increased pressure on the surface due to the displacement of the stream flow, and, as stated above, the surface pressures are taken equal to those along the slip line. For weak jets, this appears to be quite plausible, but the jet flow for strong jets must be analyzed in greater detail. Thus, the jet flow may be far from uniform. Indeed, at the downstream corner of the orifice there will be a locally supersonic bubble and probably local separation. The reaction force of the jet cannot be truly calculated until the nonuniform flow at the jet exit is known. Momentum considerations of both the jet and stream may prove helpful in a more detailed study of strong jets. The increased stream pressures depend on the initial slope of the slip line rather than on the final stream displacement distance (jet flow height). Thus, depending upon the interaction flow regime, substantial interaction forces may be realized using small mass flow jets.

Interaction Flow Regimes for $M_{jd} = 1$

The interaction flow regimes for $M_{jd} = 1$ are shown in Fig. 13 on the following page. The P_I curve does not exist because the nozzle is choked at the exit for all free stream Mach numbers; indeed, the same would be true for all nozzles having $M_{jd} < 1.763$.

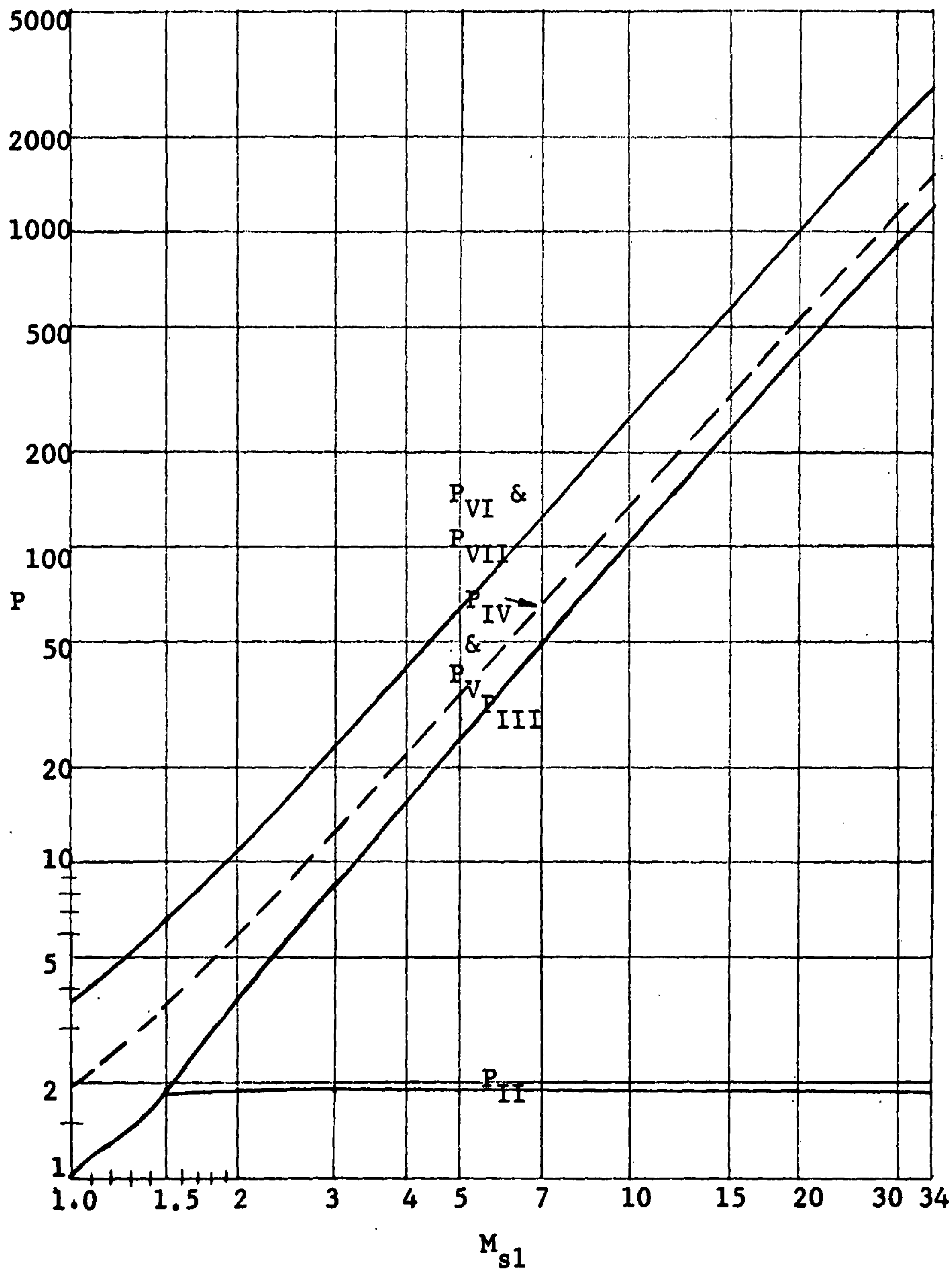

Fig. 13 - Interaction Flow Regimes for $M_{jd} = 1$

P_{II} is nearly constant for nozzles with $M_{jd} \lesssim 3$ and, for these M_{jd} values, is always less than P_I wherever the latter exists. Above the P_{II} curve, the jet flow passes through a minimum area section where it becomes sonic; the final velocity of the jet flow is supersonic. Below P_{II} the final velocity will be subsonic; compressibility corrections may be made to an analysis using the Schwartz-Christoffel transformation, but rapid viscid mixing of the jet and stream flows is to be expected. The stream shock is attached for all values of P and M_{s1} in both regions below the P_{III} curve. In these flow regimes, the stream is always supersonic; stream flow characteristics are readily obtainable by using the oblique shock relations and then Prandtl-Meyer expansion. The jet flow stagnates at the start of the slip line. In the vicinity of the upstream corner, the subsonic jet flow may be analyzed using potential theory for perfect fluid flow in a sharp corner.

The stream shock, although still attached at the start of the slip line, is curved and $M_{s2} < 1$ for values of P and M_{s1} in the flow regime bounded by the P_{III} and P_{IV} curves in Fig. 13. A large pressure increase behind the stream shock may be realized before the initial angle of the slip line increases and the stream shock detaches. The jet flow stagnates at the upstream corner. Since there is no total pressure loss across a Mach 1 shock, the jet flow stagnation pressure is the same at the upstream corner whether or not there is a shock at the $M_{jd} = 1$ nozzle exit, and so P_{IV} and P_V coincide for this case. For choked nozzles with $M_{jd} > 1$, $P_V > P_{IV}$.

The slip line moves outward as the pressure ratio increases over P_V. For $M_{jd} = 1$, the stream flow deflection angle must be 90 degrees before an attached shock can exist in the jet. It would be a normal shock of vanishing strength ($p_2 = p_1$ for a sonic shock). Thus, the curve for P_{VI} represents the pressure ratio required for zero deflection of the jet at the upstream corner and therefore is identical to the P_{VII} curve which represents no jet compression at the upstream corner. The exterior jet flow is entirely supersonic for P and M_{s1} values in the flow regime above the P_{VII} curve. Thus, the jet flow is amenable to supersonic theory solutions such as the characteristics method. The matching conditions along the slip line may be determined as indicated in the above subsection on Interaction Forces.

Interaction Flow Regimes for $M_{jd} = 5$

Further understanding of the various types of interference forces available may be obtained by considering supersonic nozzles. The $P - M_{s1}$ regions for the different types of interaction flows possible for a $M_{jd} = 5$ nozzle are shown in Fig. 14 on the following page. The curves are taken from the tables in the Appendix.

Below the P_I curve the jet nozzle is choked; the flow in the nozzle is subsonic and stagnates at the upstream corner. Below the P_{II} curve the final jet flow is subsonic, whether or not the jet nozzle is choked, and rapid mixing between the jet and stream flows is to be expected. The P_{II} curve starts at the curve indicating attached stream shocks at a value of $P \approx 30$. The value of P_{II} changes little, increasing and then decreasing slightly, until, around $M_{s1} = 12$, it drops suddenly below the P_I curve. If P_{II} is less than P_I, as it is for $M_{jd} = 5$ and $M_{s1} > 12$, then the jet nozzle flow is choked, and there are no large pressure losses in the nozzle. In this case a relatively low pressure ratio is sufficient to yield sonic flow. If, on the other hand, a larger pressure is required for sonic jet flow than is required for choking, the jet nozzle can start and undergo a strong shock wave yielding large pressure losses before attaining the pressure necessary to become sonic. Thus, in the lowest $P - M_{s1}$ region in Fig. 14, below both the P_I and P_{II} curves, the jet nozzle is choked and the jet flow is always subsonic. In the region between $M_{s1} \approx 1.2$ and $M_{s1} \approx 12$, bounded by the P_I, P_{II}, and P_{III} curves, the jet flow is sonic at the nozzle throat but normal shocks in the jet nozzle are to be expected with their large attendant pressure losses. The jet flow remains subsonic downstream of the normal shocks. In the triangular region bounded by the P_I and P_{II} curves, with apex at $M_{s1} \approx 12$, the jet flow is choked in the nozzle but becomes supersonic downstream of a fluid throat. In all three regions discussed above the stream shock is attached, and the stream flow is everywhere supersonic.

The jump in the P_{III} curve where it meets the choking curve at $M_{s1} \approx 1.2$ is due to the possibility of large normal-shock pressure losses in the jet flow if the nozzle can start. Everywhere below the P_{III} curve the stream shock is attached and the stream flow entirely supersonic. Thus, in the large,

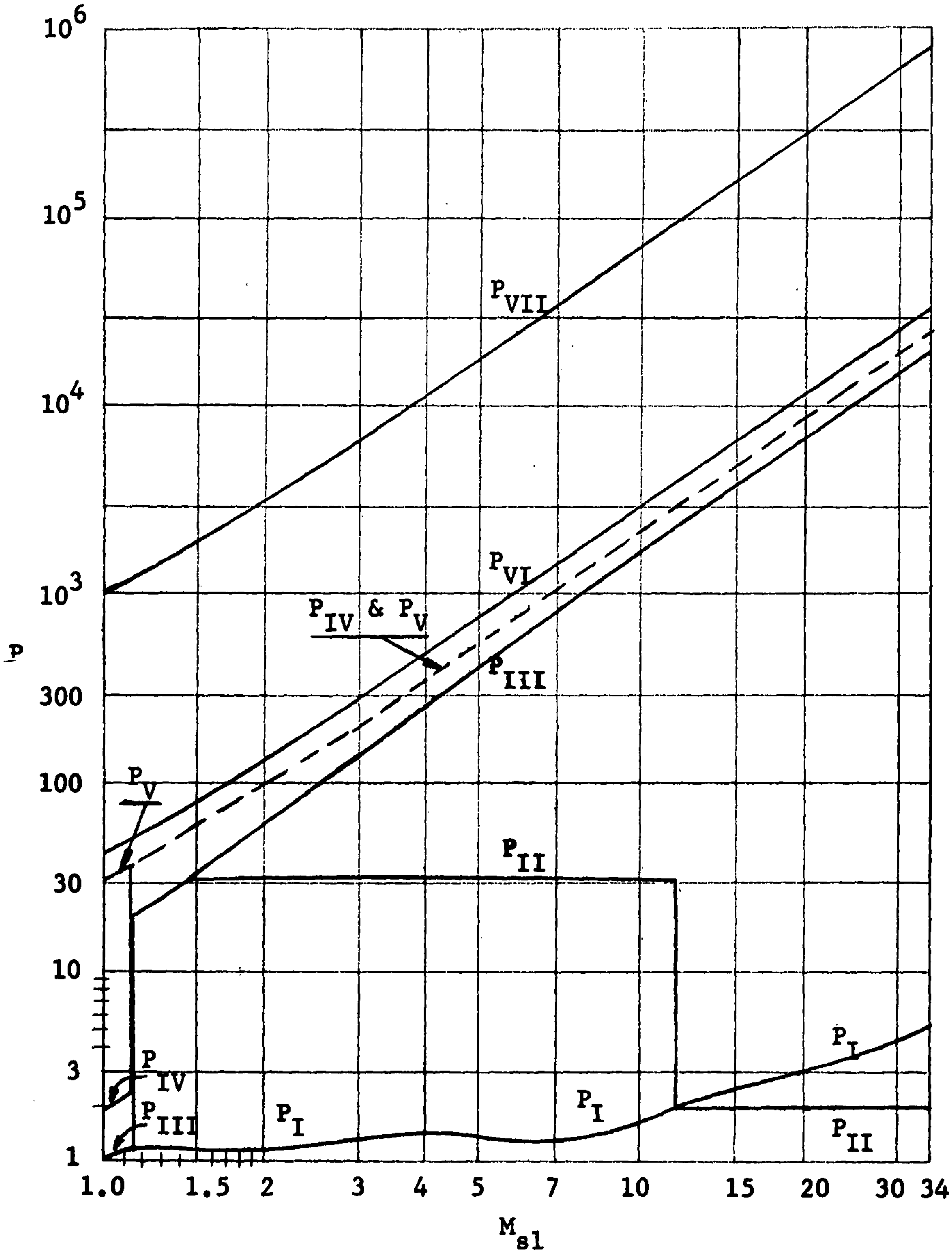

Fig. 14 - Interaction Flow Regimes for $M_{jd} = 5$

irregularly shaped region in Fig. 14, bounded above by P_{III} and below by P_{II} and P_I, the stream flow is everywhere supersonic and normal shocks are to be expected in the jet nozzle with the jet flow again becoming supersonic downstream of a fluid throat.

In the small region near the origin of Fig. 14, bounded above by P_{IV} and below by P_{III}, the pressure ratios would be sufficient to cause subsonic flow behind the stream shock but insufficient to start the jet nozzle. The jump in the P_{IV} curve, as for the P_{III} curve, occurs when normal shocks can exist in the jet nozzle. In the region between the P_{III} and P_{IV} curves above $M_{s1} \approx 1.2$, the stream shock is attached, but the stream flow is subsonic immediately behind the shock. The P_V curve, indicating a normal shock in the jet flow at the nozzle exit, is coincident with the P_{IV} curve except for values of M_{s1} less than about 1.2. For values of $M_{s1} < 1.2$, in the region bounded above by P_V and below by P_{IV}, the stream shock is detached and normal shocks in the jet nozzle are also to be expected.

Analyses of interaction flows having pressure ratio and stream Mach number values in the region between the P_V and P_{VI} curves would be very complicated. The stream shock would be detached and there may exist a curved jet shock normal to the nozzle wall at the upstream corner. In the $P - M_{s1}$ region above the P_{VI} curve, the interaction flows are characterized by detached stream shocks and jet shocks that are attached at the upstream corner. The jet flow is entirely supersonic downstream of the nozzle throat; the stream flow is that over a forward facing step. Jet flow separation at the downstream corner is to be expected in both regions above the P_{VI} curve. The uppermost, P_{VII}, curve indicates the pressure ratios required for zero jet flow deflection at the upstream corner. Above the P_{VII} curve the jet flow expands supersonically upstream and then is slowly turned downstream by the stream flow which would be similar to flow over a blunt forward facing step. Stream flow separation at the upstream corner should be expected along with increased pressure over the surface upstream of the orifice up to the stream shock.

Interaction Flow Regimes for $M_{jd} = 12$

There are 12 possible types of interaction flows for hypersonic jet nozzles with design jet Mach numbers greater than about 10. The different flow regimes possible for $M_{jd} = 12$ are shown

in the P versus M_{s1} graph (Fig. 15) on the following page.

The P_I curve is extremely close to the $P = 1$ line; only for extremely small pressure ratios can the jet flow be choked. Thus, except for very weak jets which would be similar to film-cooling type flows, the jet flow at the nozzle throat will be sonic. Normal shocks in the jet nozzle are to be expected for pressure ratios greater than P_I. In the region between the P_I and P_{II} curves, the pressure ratio is sufficient to start supersonic flow in the jet nozzle but, because of the large pressure losses associated with strong shocks in the nozzle, insufficient to guarantee that the final velocity of the jet flow be supersonic. Thus, the jet flow will become supersonic downstream of the nozzle throat, will undergo a normal shock and stagnate at the upstream corner, and will then accelerate subsonically to its final velocity downstream of the orifice. The stream flow is everywhere supersonic for values of P and M_{s1} in this region. As indicated in the tables in the Appendix, the P_I and P_{II} curves do not cross for all $M_{jd} \geq 7$.

The P_{III} curve jumps where it meets the P_I curve just above $M_{s1} = 1.04$. The sudden increase in the value of P_{III} at $M_{s1} \approx 1.04$, and similarly for P_{IV}, is due to the possibility of large pressure losses in the jet flow due to normal shocks in the nozzle. The supersonic theory used herein, although of very questionable validity for $M_{s1} < 1.04$, indicates the flows characterized by values of P and M_{s1} in the region near the origin of Fig. 15 bounded by the P_{III} and P_{IV} curves will have curved stream shocks attached at the start of the slip line with subsonic stream flow immediately behind the shock. The stream shock would be detached for values of $M_{s1} < 1.04$ and P in the region bounded by the P_{IV} and P_V curves. Flows having values of M_{s1} and P in the triangularly shaped region, vertex at $M_{s1} \approx 1.5$ and bounded by the P_{II} curve and segments of the P_{III} and P_V curves, are characterized by attached stream shocks and normal shocks in the jet nozzle with the final jet flow being supersonic.

For this case of $M_{jd} = 12$, the P_{III} and P_V curves cross suddenly just above $M_{s1} = 17.5$. Simultaneously, P_{IV} and P_{VI} cross. These jumps are due to the possibility of both the stream and jet flows having attached shocks at the start of the slip line. This possibility of attached shocks in both flows, as

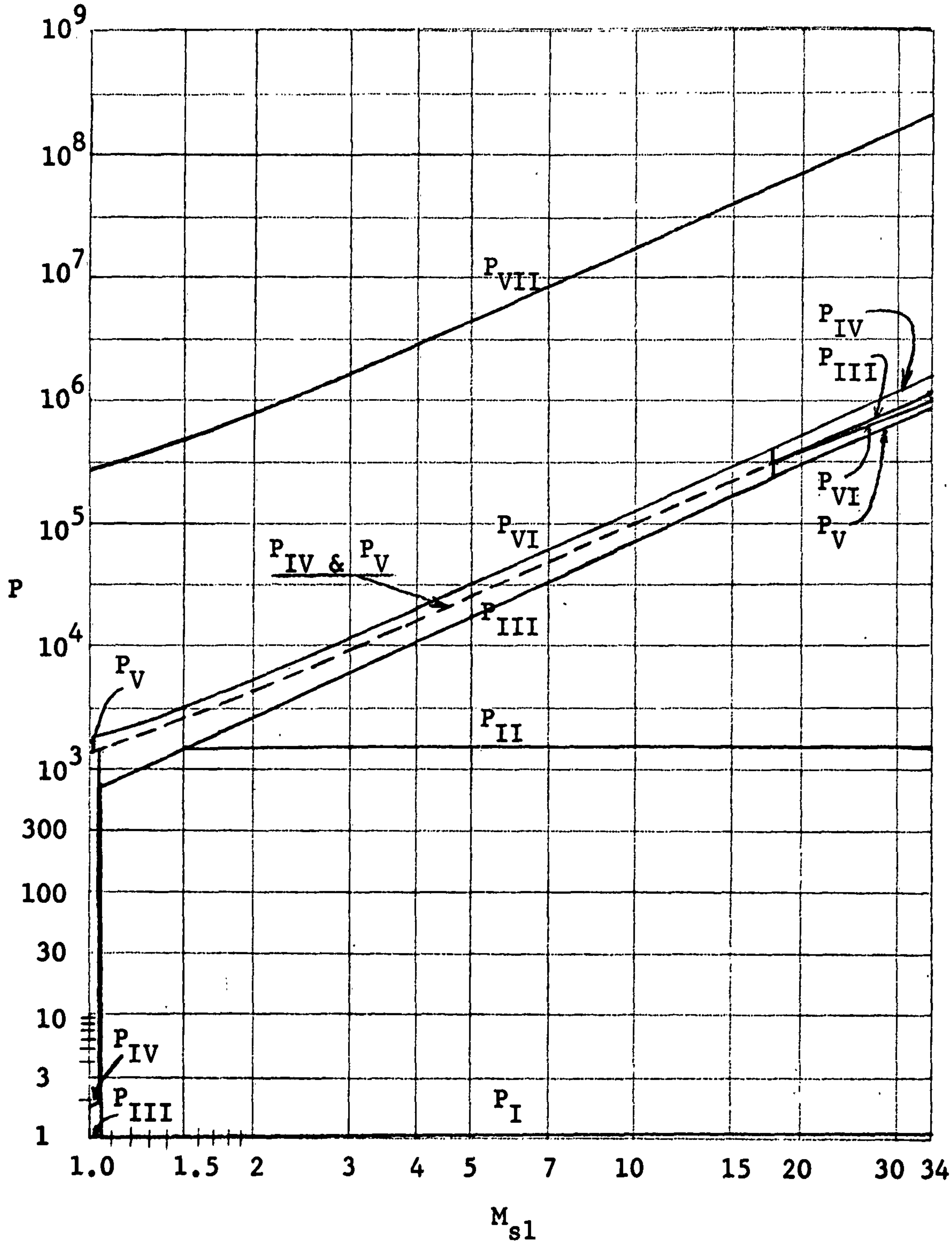

Fig. 15 - Interaction Flow Regimes for $M_{jd} = 12$

sketched in Fig. 9, exists only for the sets of values of M_{jd} and M_{s1} indicated in Fig. 10. The flow regime having values of P and M_{s1} in the small triangular region with vertex at $M_{s1} \approx 17.5$, bounded by P_{VI} and above by P_{III}, theoretically has jet and stream flows that are always supersonic. A sample force calculation for such a flow is given on pages 50-52 for $M_{jd} = 30$. In the lower region, bounded by the segments of the P_V and P_{VI} curves for $M_{s1} > 17.5$, both stream and jet shocks are attached, but the jet shock would be curved with subsonic flow immediately behind it. The upper region, bounded by P_{III} and P_{IV}, indicates flow conditions for which the stream shock will be curved but attached and there will be an attached shock in the jet flow at the upstream corner. The jet flow is supersonic everywhere, but the stream flow is subsonic immediately behind the stream shock wave.

The P_{IV} and P_V curves are coincident for stream Mach numbers in the range $1.04 < M_{s1} < 17.5$. Consider the $P - M_{s1}$ region within this Mach number range that is bounded below by P_{III} and above by the coincident segments of P_{IV} and P_V. Within this flow regime the stream shock is attached but curved, and normal shocks are expected in the jet nozzle. The stream flow is subsonic immediately behind the curved shock which is attached at the start of the slip line. In the region above the P_V curve and below the P_{VI} curve, for $M_{s1} < 17.5$, the stream shock is detached, and a curved shock attached at the start of the slip line can theoretically exist in the jet flow.

Above the P_{VI} curve and below the P_{VII} curve, the jet flow passes through a shock wave attached at the start of the slip line. Above the P_{IV} curve the stream shock must be detached. The jet flow is entirely supersonic and the stream shock detached in the $P - M_{s1}$ region bounded below by segments of the P_{VI} and, for $M_{s1} > 17.5$, P_{IV} curves and bounded above by the P_{VII} curve. Values of P and M_{s1} along the P_{VII} curve indicate zero jet flow deflection at the upstream corner. Above P_{VII} the jet suffers no compression at the nozzle exit; the stream shock is detached and increased surface pressure between the shock and the jet orifice is to be expected.

Interaction Flow Regimes for $M_{jd} = 30$

The P versus M_{s1} graph on the following page, Fig. 16, is for the maximum M_{jd} value shown in the tables in the Appendix and represents a limiting condition. The extremely large nozzle area ratio would essentially maximize the specific impulse and pure reaction force of the jet used in a vacuum (see following subsection). In the "near" vacuum existing at altitudes of 50 or 60 miles, however, interference effects are important and substantially change the control force of the jet, as evidenced by the examples given in the following subsection.

For $M_{jd} = 30$, for all practical purposes, the jet flow is never choked; the P_I curve is almost coincident with the $P = 1$ axis in this limiting case. The P_I curve meets the P_{III} curve at a value of $M_{s1} < 1.01$; the steps in the P_{III} and P_{IV} curves are almost coincident with the $M_{s1} = 1$ axis. Thus, normal shocks and large pressure losses are to be expected in the jet nozzle flow, and the stream shock will be attached for this $M_{jd} = 30$ case for even the very large values of P shown in Fig. 16. The large P_{III} values result from the largeness of the possible jet pressure loss across a Mach 30 normal shock. Similar to the description in the preceding subsection, the $P - M_{s1}$ region bounded by the P_I and P_{II} curves will be characterized by entirely supersonic stream flows and jet flows having normal shocks in the nozzle, remaining subsonic thereafter. In the triangular region bounded by the P_{II} curve and segments of the P_{III} and P_V curves, the jet flow passes through a second fluid throat and finally becomes supersonic.

Attached jet and stream shocks can exist simultaneously in this $M_{jd} = 30$ case for $M_{s1} \geq 11$. Both flows will be entirely supersonic for P and M_{s1} values in the triangular region bounded by segments of the P_{III} and P_{VI} curves. In the adjoining lower region, the jet shock will be curved with subsonic flow immediately behind it; in the adjoining upper region, the stream shock will be curved. Both shocks cannot be simultaneously attached for $M_{s1} < 11$. The stream shock will be curved and the jet flow will pass through a normal shock in the nozzle for P and M_{s1} values in the region bounded below by P_{III} and above by the coincident segments of the P_{IV} and P_V curves. In the adjoining upper region, the stream shock will be detached and a curved jet shock will attach at the start of the slip line.

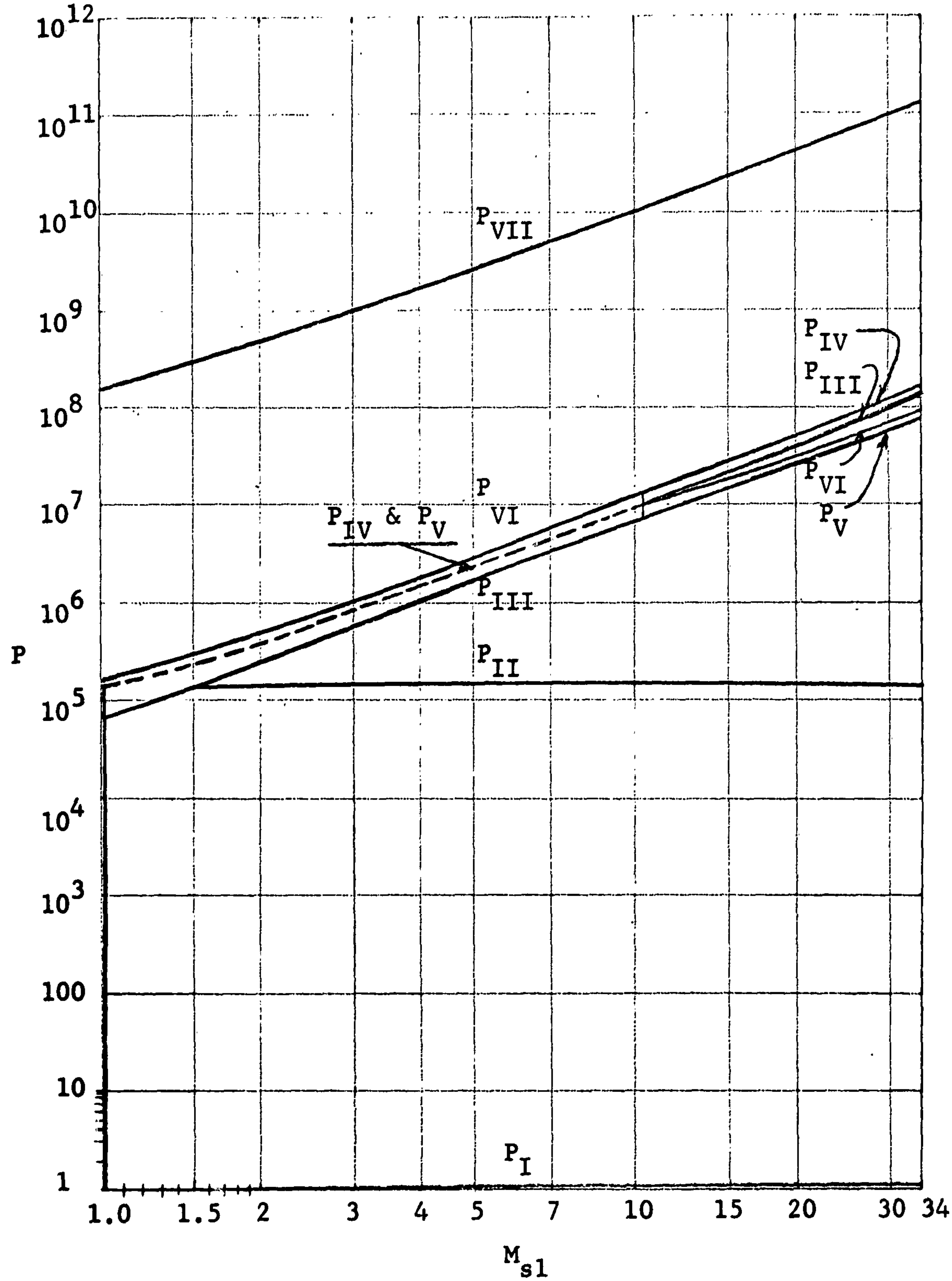

Fig. 16 - Interaction Flow Regimes for $M_{jd} = 30$

An attached shock with supersonic flow behind it will exist in the jet flow and the stream shock will be detached for interaction flows characterized by P and M_{s1} values in the region bounded by P_{VII} and segments of the P_{VI} and P_{IV} curves in Fig. 16. No jet shock occurs in the uppermost region; the jet flow initially expands forward for P and M_{s1} values above the P_{VII} curve.

Sample Force Calculations

The interaction flow regime for a given case must be known before the force may be calculated. The importance of the interference effects and some problems inherent in the force calculations are indicated in the following examples. Additional examples are presented in Ref. 19.

Consider the interaction flow defined by: $M_{jd} = 1.0$, $M_{s1} = 3.9$, and $P = 14$. This set of values falls into the region between the P_{II} and P_{III} curves shown in Fig. 13. The final jet flow is supersonic; there are no shocks in the jet nozzle; the stream shock wave is attached. Stagnation pressure is reached in the jet flow at the upstream corner and this must equal the stream pressure at the start of the slip line just downstream of the attached stream shock; thus, using $P = 14$,

$$P = \frac{p_{j0}}{p_{s1}} = \frac{p_{s2}}{p_{s1}} = \xi = 14 \quad .$$

Knowing ξ and M_{s1}, the stream deflection angle δ and M_{s2} may be determined from Eqs. (5) and (6), page 15. Tables are then used to determine the Prandtl-Meyer angle ν_2 corresponding to $M_{s2} = 1.0655$. The total expansion angle $\Delta\nu$ must equal the deflection angle (for jet flow continuity):

$$\nu_f = \Delta\nu + \nu_2 = \delta + \nu_2 \quad .$$

Tables are again used to determine p_{sf}/p_{s20} corresponding to ν_f. Thence,

$$\frac{p_{sf}}{p_{s1}} = \frac{p_{sf}}{p_{s20}} \cdot \frac{p_{s20}}{p_{s2}} \cdot \frac{p_{s2}}{p_{s1}} = 0.05927\left(\frac{1}{0.4890}\right)14 = 1.697 \; .$$

The over-pressure imposed on the jet, $p_{sf} - p_{s1}$, gives an interaction control force acting on the surface downstream of the jet orifice. Consider a case where the span of the jet is b and the length over which the over-pressure acts is ℓ. The interaction jet force for this example is then:

$$F_i = (p_{sf} - p_{s1})b\ell = 0.697\ p_{s1}b\ell \tag{32}$$

Again, p_{sf} is constant in this analysis; in practice it may decrease slightly many orifice diameters downstream. On the other hand, the expansion may not be completed until far downstream, and in this case, the pressure acting on the surface would exceed p_{sf}. Any stream separation upstream of the jet flow would give rise to an additional force acting over the separated area upstream of the orifice and would slightly reduce the over-pressure downstream of the orifice.

For comparison purposes consider a jet nozzle exit area of one square inch, the jet reaction forces F_v and F_a for this example are, from Eqs. (30) and (31), page 33, $F_v = 17.75\ p_{s1}$ and $F_a = 16.75\ p_{s1}$, where the units of p are taken as pounds per square inch. The vacuum force agrees perfectly with Amick's result for the same conditions (Ref. 5).

If the jet orifice is circular and is located just a foot from the trailing edge; $b = 2\sqrt{1/\pi} = 1.128"$ and $\ell = 12"$. Then, from Eq. (32), $F_i = 9.43 p_{s1}$ which is greater than fifty per cent of the reaction force F_a. If the orifice is a two-dimensional slit of equal area but 10 inches wide ($b = 10"$), and if ℓ is still 12 inches, $F_i = 83.6\ p_{s1}$. This is several times larger than even the vacuum jet force and hence serves as an example of the substantial interference forces possibly available for control. These interference forces may be much greater than the pure reaction forces of the jet which are unaffected by the shape of the jet orifice. Even to the roughness of this estimate the substantial forces are evident.

The reaction force of a given jet may be increased by accelerating the jet flow in a nozzle. Thus, from Eqs. (30) and (31), page 33, we obtain:

$$\begin{aligned}
&\text{For}\quad M_{jd} = 1.0 \\
&F_v = 1.268\, p_{j0} A_* \quad \text{and} \quad F_a = (1.268\, p_{j0} - p_{s1}) A_* \\
&\text{For}\quad M_{jd} = 30 \\
&F_v = 1.808\, p_{j0} A_* \quad \text{and} \quad F_a = 1.808\, p_{j0} A_* - p_{s1} A_e \ .
\end{aligned} \tag{33}$$

Substantial specific impulse improvements may be realized by using large nozzles (necessary for large values of A_e/A_* without causing separation), but the improvements diminish beyond very large values of M_{jd} (for $M_{jd} \to \infty$, $F_v \to 1.812\, p_{j0}A_*$). Large nozzles are useful to maximize essentially the reaction forces of jets used in a vacuum where the pressure ratio P would be infinite. The interaction forces become important when P, although very large, is nevertheless finite and the available control force of the jet may be greatly modified.

Consider $P = 2 \cdot 10^7$; this would correspond, for example, to a jet reservoir pressure $p_{j0} = 20$ atm. at an altitude of about 60 miles (Ref. 18). As a numerical example of the interaction forces possible at such extreme altitudes, let $M_{s1} = 15$ and $M_{jd} = 30$. These conditions are in the region in Fig. 16 of interaction flows characterized by attached shock waves in both the jet and stream flows. Hence [cf. Eqs. (18) and (25)],

$$P = \frac{p_{j0}}{p_{s1}} = \frac{p_{j0}}{p_{j1}} \cdot \frac{p_{j1}}{p_{j2}} \cdot \frac{p_{j2}}{p_{s2}} \cdot \frac{p_{s2}}{p_{s1}} = \frac{p_{j0}}{p_{j1}} \cdot \frac{1}{\xi_j} \cdot \frac{p_{j2}}{p_{s2}}\, \xi = 2 \cdot 10^7 \ .$$

Solving for ξ, noting that $p_{j1}/p_{j0} = 0.1254 \cdot 10^{-7}$ for $M_{jd} = 30$ (Ref. 10), and requiring pressure equalization across the slip line $(p_{j2} = p_{s2})$,

$$\xi = 0.2508 \; \xi_j \tag{34}$$

This equation is to be solved simultaneously with the geometric condition $\delta_j = 90° - \delta$ (cf. Fig. 9). The solution may be accomplished analytically, or far more simply, by using tables (Ref. 11). Noting that $\tan^2 \delta_j \tan^2 \delta = 1$, Eq. (5), page 15, may be used for both the jet and stream flows. Eliminating ξ using Eq. (34) and using $M_{s1} = 15$ and $M_{jd} = 30$, a single sixth order equation is obtained in the single unknown ξ_j. Four roots are imaginary, one root $(\xi_j = 928.7)$ represents the strong shock solution (subsonic flows aft of both jet and stream shocks), and one root $(\xi_j = 858.4)$ yields the desired weak shock solution. Using tables, the same results are obtained much more readily. A value of M_{s2} is chosen and the δ and ξ corresponding to M_{s1} and M_{s2} are found. Then, corresponding to $\delta_j = 90° - \delta$ and M_{jd}, ξ_j is found from the tables. If ξ/ξ_j is larger than indicated by Eq. (34), a larger M_{s2} value is chosen as the next approximation; the value chosen for M_{s2} is decreased if the value of ξ/ξ_j is too low. The process is iterated and quickly converges to the desired results. The present example, accomplished both analytically and with the use of the tables, yields:

$$M_{s2} = 1.113 \qquad \delta = 44.84° \qquad \xi = 215.3$$

$$M_{j2} = 1.133 \qquad \delta_j = 45.16° \qquad \xi_j = 858.4$$

Equating the stream expansion angle $\Delta\nu$ to the deflection angle δ and noting that the Prandtl-Meyer angle for $M_{s2} = 1.113$ is $\nu_2 = 1.593°$ (Ref. 10), there follows $M_{sf} = 2.833$ and

$$\frac{p_{sf}}{p_{s2}} = \frac{p_{sf}}{p_{s20}} \cdot \frac{p_{s20}}{p_{s2}} = \frac{0.03504}{0.4609} = 0.07603 \ .$$

Whence

$$\frac{p_{sf}}{p_{s1}} = \frac{p_{sf}}{p_{s2}} \xi = 16.37 \ .$$

Thus, the pressure acting on the area downstream of the jet orifice is over 16 times as great as the undisturbed stream pressure and can be a substantial portion of the available control force. The interaction force due to the over-pressure downstream of the orifice is

$$F_i = (p_{sf} - p_{s1})b\ell = 15.37\ p_{s1}b\ell \ , \tag{35}$$

where b is the span of the jet and ℓ is the length over which the over-pressure acts.

The reaction force F_a for $M_{jd} = 30$ and $P = 2 \cdot 10^7$, from Eq. (33), page 50, and $A_e/A_* = 114{,}400$ (Ref. 10), is $F_a = 315.1\ p_{s1}A_e$. If the nozzle is axisymmetric with circular orifice of diameter b and if, for example, $\ell = 10b$, then using $A_e = \frac{\pi}{4} \cdot b^2$ and Eq. (35), $F_i = 195.7\ p_{s1}A_e = 0.621\ F_a$. If the nozzle orifice was either rectangular with aspect ratio 25 or oblong so that $b = 5\sqrt{A_e}$, then, still with $\ell = 10b$; $F_i = 3{,}843\ p_{s1}A_e = 12.2\ F_a$. Much greater values of F_i/F_a could theoretically be achieved if narrow slit type nozzles were used.

If the Mach 30 jet were used at a much lower altitude, then the available control force would differ drastically from the theoretical reaction force. Indeed, for $M_{s1} = 3.90$ and $P = 14$, a negative value of F_a is indicated by Eq. (33), page 50, $(F_a = -0.9998\ p_{s1}A_e)$. Interference effects must be considered.

For $M_{s1} = 3.90$ and $P = 14$, as indicated in Fig. 16, there are normal shocks in the jet nozzle after which the flow remains subsonic. Thus, as explained on pages 21 through 23, $\xi < 2$ and so

$$\frac{p_{j20}}{p_{j0}} = \xi \frac{p_{s1}}{p_{j0}} < \frac{2}{14} = 0.1429 \quad .$$

This would be the maximum jet pressure loss and corresponds approximately to a Mach 3.965 normal shock. A lower bound of the interaction force may, very roughly, be taken as the jet over-pressure downstream of the normal shock $(p_{j2} - p_{s1})$ acting over the nozzle exit area downstream of the shock. For a jet shock at $M_{j1} = 3.965$ it follows that: The nozzle area at the location of the shock is $A = 10.39A_*$; the downstream Mach number is $M_{j2} = 0.4359$, and $p_{j2}/p_{j20} = 0.8776$ (Ref. 10). Therefore, even for maximum jet pressure loss,

$$F_i = (p_{j2} - p_{s1})(A_e - A_{M=3.965})$$

$$= \left(\frac{p_{j2}}{p_{j20}} \cdot \frac{p_{j20}}{p_{j0}} - \frac{p_{s1}}{p_{j0}}\right) p_{j0} \left(\frac{A_e}{A_*} - \frac{A_{M=3.965}}{A_*}\right) A_*$$

$$= (0.1254 - 0.0714)(114{,}400 - 10.39) p_{j0} A_* = 6{,}180 \; p_{j0} A_* \; .$$

This interaction force is several orders of magnitude larger than even the vacuum reaction force shown in Eq. (33), page 50.

Particularly in the last example, a much more detailed study of interaction flows must be made to correctly ascertain the magnitude of the available control forces. The force may be optimized for given P and M_{s1} values by a circumspect choice of M_{jd}. Viscid effects must be included to determine separation regions and the over-pressure acting upstream of the jet (as in Ref. 8) and the influence of three-dimensional flow effects must be determined. At least, however, the preceding sections serve to indicate the type of flow that may be expected under various M_{s1}, M_{jd}, and P conditions and some of the salient features of the interaction flows.

CONCLUSIONS AND RECOMMENDATIONS

A systematic study of flows past transverse jets has been initiated by categorically examining the types of two-dimensional, inviscid, interaction flows theoretically possible. Supersonic jets, advantageous for their large specific impulse, were included in the analyses. The two-dimensional approach is straightforward, eliminates the need for additional, usually more obscure, assumptions, and is particularly appropriate for the study of weak jets. Several advantages of weak jets, for which the interaction phenomena are two-dimensional in nature, are noted. As borne out by the consistency of the results, the two-dimensional inviscid interaction problem is uniquely described by three variables: the undisturbed stream Mach number, the design Mach number of the jet nozzle, and the ratio of the jet stagnation pressure to the undisturbed stream static pressure. Limit curves, which separate the different types of interaction flows, are tabulated in the Appendix in terms of the three variables. Each type of flow is described and sample force calculations and comparisons are carried out.

The sample force calculations serve to show that the control force of a jet is significantly altered by the interaction. Large interaction forces, several times the pure reaction forces, may be obtained for flight within the atmosphere, even at altitudes in excess of 60 miles. Supersonic jet nozzles increase the specific impulse of the jet and hence its efficiency when used in a pure vacuum. Also, if the jet nozzle is expanded two-dimensionally, there will be large beneficial interaction forces. Interaction forces are greatest, on a percentage basis, for weak jets and act on the surface downstream of the jet orifice; maximum control force would be obtained by placing the orifice near the leading edge of the surface. Such a jet control would also be useful in cooling the surface downstream of the orifice; very weak jets simulate film cooling flows.

The salient features of the various types of interaction flows have been described but each type requires more detailed study. Several inviscid flow problems remain unresolved. The problem of jet flow separation at the downstream corner is expected to exist for all but very weak jets. Procedures for estimating the separation zone are to be established. A comparative analysis of the various control forces available for the different flow regimes is to be made in seeking optimum control jets. Over-pressure both

upstream and downstream of the orifice can increase the effective control force; the former is dominant for strong jets, the latter for weak jets. Finally, many viscid phenomena remain to be adequately understood.

Experimental research is required to ascertain correctly the importance of the many viscid effects. Spreading of the jet, stream and jet flow separation regions, and mixing of the stream and jet flows should be analyzed with the aid of flow photographs and surface pressure measurements. Experimental boundary layer profiles and force measurements are needed for verification of the theoretical results.

Early experimental results will guide additional theoretical work and give substance and reliability to the force estimation and calculation procedures. Vorticity along the slipline may be calculated for a few examples using the rotational characteristics method. Particularly for the subsonic flow regions, a hodograph method may prove to be useful in determining more accurately the shape of the slipline. Other theoretical methods may appear practical in the light of the experimental results. Existing theories for shock standoff distances and boundary layer separation ahead of the jet should be put into more usable form. Finally, for completeness, and for possible hydrodynamic utility, subsonic interaction flows could be studied. Transformations such as the Schwarz-Christoffel method are available for incompressible flows; even the incompressible, perfect fluid flow problem has yet to be solved. Our cursory look at the incompressible flow interaction problem indicated the fuitility of either representing the jet as a point source or representing the flows as portions of impinging streams.

Still, little is understood of the interaction of flows past transverse jets, but there are clear indications of substantial design advantages based on a rudimentary knowledge of the phenomena, and a direct, categorical approach has been taken to increase our knowledge of the phenomena.

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APPENDIX

TABLES OF PRESSURE RATIOS DEFINING THE BOUNDARIES OF THE VARIOUS TYPES OF INTERACTION FLOWS

The interaction flows considered herein are characterized by their values of M_{s1}, M_{jd}, and P; the type of interaction that will result for a given set of values may be determined using the following tables. For every jet nozzle there is a corresponding value of M_{jd}, the design jet Mach number. Several types of interaction are possible for any particular nozzle. The values of the pressure ratios P_I through P_{VII}, which separate the different types of interaction, are tabulated versus M_{s1} for 22 values of M_{jd} from 1.0 to 30. Interpolation is necessary for nozzles having M_{jd} values different from the ones listed.

Standard electronic digital computer notation is used in the tables. Subscripts appear on the same line as the variable to which they refer; thus M_{s1} is listed as MS1 and P_I as PI, etc. Floating decimal point notation is used for P_I through P_{VII} because of their large range of values; the exponent, the portion of the number following the "E", indicates the number of places the decimal point should be moved to the right. Thus, 0.3625E 01 represents 3.625 and 0.1165E 05 represents 11,650. Four significant figures are given throughout the tables which, considering the importance of separation, viscid, and three-dimensional effects, is optimistic. The pressure ratios P_I and P_{II}, as defined herein, can not exist below certain M_{s1} and M_{jd} values, this is noted in the tables by indicating their value as 0 (any value of P less than unity would indicate no jet flow).

The use of the tables is shown by example. Say it is desired to determine the type of interaction that may be expected for a $M_{jd} = 2.5$ nozzle in a stream flow such that $M_{s1} = 4.9$ and $P = 100$. Referring to the tables for $M_{jd} = 2$ and $M_{jd} = 3$ and interpolating both for $M_{s1} = 4.90$:

M_{jd}	P_{IV}	P_V	P_{VI}
2.0	0.4355E 02	0.7148E 02	0.2457E 03
3.0	0.9561E 02	0.1392E 03	0.1153E 04

Interpolating again for $M_{jd} = 2.5$, it is seen that $P = 100$ falls between the values for P_V and P_{VI}. Therefore, the interaction flow that may be expected is of the strong variety. The stream shock will be detached and there will be a curved shock in the jet flow attached at the upstream corner. Consider that it is then desired to determine the nozzle M_{jd} value for which the interaction would be of the weak variety such that the stream shock would be attached, for the same $M_{s1} = 4.9$ and $P = 100$ values. Then P_{III} must be greater than or equal to 100; again from the tables; after interpolating for $M_{s1} = 4.9$:

M_{jd}	P_{III}
3.0	0.7074E 02 = 70.74
4.0	0.1675E 03 = 167.5

Again interpolating it follows that the nozzle must be such that M_{jd} is greater than or equal to 3.30 in order for the stream shock to be attached, ignoring any viscid effects such as boundary layer separation.

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 1.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.	0.	0.1013E 01	0.1915E 01	0.1915E 01	0.3625E 01	0.3625E 01
1.04	0.	0.	0.1051E 01	0.1984E 01	0.1984E 01	0.3756E 01	0.3756E 01
1.07	0.	0.	0.1089E 01	0.2057E 01	0.2057E 01	0.3894E 01	0.3894E 01
1.10	0.	0.	0.1128E 01	0.2133E 01	0.2133E 01	0.4037E 01	0.4037E 01
1.20	0.	0.	0.1279E 01	0.2408E 01	0.2408E 01	0.4557E 01	0.4557E 01
1.30	0.	0.	0.1456E 01	0.2714E 01	0.2714E 01	0.5137E 01	0.5137E 01
1.40	0.	0.	0.1659E 01	0.3049E 01	0.3049E 01	0.5772E 01	0.5772E 01
1.50	0.	0.1871E 01	0.1889E 01	0.3413E 01	0.3413E 01	0.6461E 01	0.6461E 01
1.60	0.	0.1895E 01	0.2147E 01	0.3805E 01	0.3805E 01	0.7203E 01	0.7203E 01
1.70	0.	0.1897E 01	0.2431E 01	0.4224E 01	0.4224E 01	0.7995E 01	0.7995E 01
1.80	0.	0.1899E 01	0.2741E 01	0.4670E 01	0.4670E 01	0.8839E 01	0.8839E 01
1.90	0.	0.1900E 01	0.3076E 01	0.5142E 01	0.5142E 01	0.9733E 01	0.9733E 01
2.00	0.	0.1902E 01	0.3436E 01	0.5640E 01	0.5640E 01	0.1068E 02	0.1068E 02
2.20	0.	0.1902E 01	0.4228E 01	0.6716E 01	0.6716E 01	0.1271E 02	0.1271E 02
2.40	0.	0.1901E 01	0.5111E 01	0.7897E 01	0.7897E 01	0.1495E 02	0.1495E 02
2.60	0.	0.1900E 01	0.6082E 01	0.9181E 01	0.9181E 01	0.1738E 02	0.1738E 02
2.80	0.	0.1899E 01	0.7140E 01	0.1057E 02	0.1057E 02	0.2001E 02	0.2001E 02
3.00	0.	0.1898E 01	0.8282E 01	0.1206E 02	0.1206E 02	0.2283E 02	0.2283E 02
3.20	0.	0.1896E 01	0.9507E 01	0.1366E 02	0.1366E 02	0.2585E 02	0.2585E 02
3.40	0.	0.1895E 01	0.1082E 02	0.1535E 02	0.1535E 02	0.2906E 02	0.2906E 02
3.60	0.	0.1894E 01	0.1221E 02	0.1716E 02	0.1716E 02	0.3247E 02	0.3247E 02
3.80	0.	0.1893E 01	0.1368E 02	0.1906E 02	0.1906E 02	0.3608E 02	0.3608E 02
4.00	0.	0.1892E 01	0.1523E 02	0.2107E 02	0.2107E 02	0.3988E 02	0.3988E 02
4.20	0.	0.1892E 01	0.1686E 02	0.2318E 02	0.2318E 02	0.4388E 02	0.4388E 02
4.40	0.	0.1892E 01	0.1858E 02	0.2539E 02	0.2539E 02	0.4807E 02	0.4807E 02
4.60	0.	0.1892E 01	0.2037E 02	0.2771E 02	0.2771E 02	0.5245E 02	0.5245E 02
4.80	0.	0.1892E 01	0.2225E 02	0.3013E 02	0.3013E 02	0.5703E 02	0.5703E 02
5.00	0.	0.1892E 01	0.2421E 02	0.3265E 02	0.3265E 02	0.6181E 02	0.6181E 02

DESIGN JET MACH NUMBER = 1.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.	0.1892E 01	0.2421E 02	0.3265E 02	0.3265E 02	0.6181E 02	0.6181E 02
5.50	0.	0.1891E 01	0.2945E 02	0.3941E 02	0.3941E 02	0.7460E 02	0.7460E 02
6.00	0.	0.1891E 01	0.3519E 02	0.4682E 02	0.4682E 02	0.8862E 02	0.8862E 02
6.50	0.	0.1891E 01	0.4144E 02	0.5486E 02	0.5486E 02	0.1038E 03	0.1038E 03
7.00	0.	0.1891E 01	0.4819E 02	0.6355E 02	0.6355E 02	0.1203E 03	0.1203E 03
7.50	0.	0.1891E 01	0.5543E 02	0.7289E 02	0.7289E 02	0.1380E 03	0.1380E 03
8.00	0.	0.1891E 01	0.6318E 02	0.8287E 02	0.8287E 02	0.1569E 03	0.1569E 03
8.50	0.	0.1890E 01	0.7143E 02	0.9349E 02	0.9349E 02	0.1770E 03	0.1770E 03
9.00	0.	0.1890E 01	0.8018E 02	0.1048E 03	0.1048E 03	0.1983E 03	0.1983E 03
9.50	0.	0.1890E 01	0.8943E 02	0.1167E 03	0.1167E 03	0.2208E 03	0.2208E 03
10.00	0.	0.1890E 01	0.9918E 02	0.1292E 03	0.1292E 03	0.2446E 03	0.2446E 03
10.50	0.	0.1890E 01	0.1094E 03	0.1424E 03	0.1424E 03	0.2696E 03	0.2696E 03
11.00	0.	0.1889E 01	0.1202E 03	0.1563E 03	0.1563E 03	0.2958E 03	0.2958E 03
11.50	0.	0.1889E 01	0.1314E 03	0.1707E 03	0.1707E 03	0.3232E 03	0.3232E 03
12.00	0.	0.1889E 01	0.1432E 03	0.1859E 03	0.1859E 03	0.3518E 03	0.3518E 03
12.50	0.	0.1889E 01	0.1554E 03	0.2016E 03	0.2016E 03	0.3817E 03	0.3817E 03
13.00	0.	0.1889E 01	0.1682E 03	0.2181E 03	0.2181E 03	0.4128E 03	0.4128E 03
13.50	0.	0.1889E 01	0.1814E 03	0.2351E 03	0.2351E 03	0.4451E 03	0.4451E 03
14.00	0.	0.1888E 01	0.1952E 03	0.2528E 03	0.2528E 03	0.4786E 03	0.4786E 03
14.50	0.	0.1888E 01	0.2094E 03	0.2712E 03	0.2712E 03	0.5133E 03	0.5133E 03
15.00	0.	0.1888E 01	0.2242E 03	0.2902E 03	0.2902E 03	0.5493E 03	0.5493E 03
15.50	0.	0.1888E 01	0.2394E 03	0.3098E 03	0.3098E 03	0.5864E 03	0.5864E 03
16.00	0.	0.1888E 01	0.2552E 03	0.3301E 03	0.3301E 03	0.6248E 03	0.6248E 03
16.50	0.	0.1888E 01	0.2714E 03	0.3510E 03	0.3510E 03	0.6644E 03	0.6644E 03
17.00	0.	0.1887E 01	0.2882E 03	0.3726E 03	0.3726E 03	0.7052E 03	0.7052E 03
17.50	0.	0.1887E 01	0.3054E 03	0.3948E 03	0.3948E 03	0.7473E 03	0.7473E 03
18.00	0.	0.1887E 01	0.3232E 03	0.4176E 03	0.4176E 03	0.7905E 03	0.7905E 03
18.50	0.	0.1887E 01	0.3414E 03	0.4411E 03	0.4411E 03	0.8350E 03	0.8350E 03
19.00	0.	0.1887E 01	0.3602E 03	0.4653E 03	0.4653E 03	0.8807E 03	0.8807E 03
19.50	0.	0.1886E 01	0.3794E 03	0.4901E 03	0.4901E 03	0.9276E 03	0.9276E 03

DESIGN JET MACH NUMBER = 1.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.	0.1886E 01	0.3794E 03	0.4901E 03	0.4901E 03	0.9276E 03	0.9276E 03
20.00	0.	0.1886E 01	0.3992E 03	0.5155E 03	0.5155E 03	0.9758E 03	0.9758E 03
20.50	0.	0.1886E 01	0.4194E 03	0.5416E 03	0.5416E 03	0.1025E 04	0.1025E 04
21,00	0.	0.1886E 01	0.4402E 03	0.5683E 03	0.5683E 03	0.1076E 04	0.1076E 04
21,50	0.	0.1886E 01	0.4614E 03	0.5956E 03	0.5956E 03	0.1127E 04	0.1127E 04
22.00	0.	0.1886E 01	0.4832E 03	0.6236E 03	0.6236E 03	0.1181E 04	0.1181E 04
22.50	0.	0.1885E 01	0.5054E 03	0.6523E 03	0.6523E 03	0.1235E 04	0.1235E 04
23.00	0.	0.1885E 01	0.5282E 03	0.6816E 03	0.6816E 03	0.1290E 04	0.1290E 04
23.50	0.	0.1885E 01	0.5514E 03	0.7115E 03	0.7115E 03	0.1347E 04	0.1347E 04
24.00	0.	0.1885E 01	0.5752E 03	0.7421E 03	0.7421E 03	0.1405E 04	0.1405E 04
24.50	0.	0.1885E 01	0.5994E 03	0.7733E 03	0.7733E 03	0.1464E 04	0.1464E 04
25.00	0.	0.1884E 01	0.6242E 03	0.8052E 03	0.8052E 03	0.1524E 04	0.1524E 04
25.50	0.	0.1884E 01	0.6494E 03	0.8377E 03	0.8377E 03	0.1586E 04	0.1586E 04
26.00	0.	0.1884E 01	0.6752E 03	0.8709E 03	0.8709E 03	0.1648E 04	0.1648E 04
26.50	0.	0.1884E 01	0.7014E 03	0.9046E 03	0.9046E 03	0.1712E 04	0.1712E 04
27.00	0.	0.1884E 01	0.7282E 03	0.9391E 03	0.9391E 03	0.1778E 04	0.1778E 04
27.50	0.	0.1884E 01	0.7554E 03	0.9742E 03	0.9742E 03	0.1844E 04	0.1844E 04
28.00	0.	0.1883E 01	0.7832E 03	0.1010E 04	0.1010E 04	0.1912E 04	0.1912E 04
28.50	0.	0.1883E 01	0.8114E 03	0.1046E 04	0.1046E 04	0.1981E 04	0.1981E 04
29.00	0.	0.1883E 01	0.8402E 03	0.1083E 04	0.1083E 04	0.2051E 04	0.2051E 04
29.50	0.	0.1883E 01	0.8694E 03	0.1121E 04	0.1121E 04	0.2122E 04	0.2122E 04
30.00	0.	0.1883E 01	0.8992E 03	0.1159E 04	0.1159E 04	0.2194E 04	0.2194E 04
30.50	0.	0.1882E 01	0.9294E 03	0.1198E 04	0.1198E 04	0.2268E 04	0.2268E 04
31.00	0.	0.1882E 01	0.9602E 03	0.1238E 04	0.1238E 04	0.2343E 04	0.2343E 04
31.50	0.	0.1882E 01	0.9914E 03	0.1278E 04	0.1278E 04	0.24'9E 04	0.2419E 04
32.00	0.	0.1882E 01	0.1023E 04	0.1319E 04	0.1319E 04	0.2497E 04	0.2497E 04
32.50	0.	0.1882E 01	0.1055E 04	0.1360E 04	0.1360E 04	0.2575E 04	0.2575E 04
33.00	0.	0.1882E 01	0.1088E 04	0.1403E 04	0.1403E 04	0.2655E 04	0.2655E 04
33.50	0.	0.1881E 01	0.1121E 04	0.1445E 04	0.1445E 04	0.2736E 04	0.2736E 04
34.00	0.	0.1881E 01	0.1155E 04	0.1489E 04	0.1489E 04	0.2818E 04	0.2818E 04

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 1.5

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.	0.	0.1013E 01	0.1915E 01	0.2060E 01	0.3721E 01	0.7031E 01
1.04	0.	0.	0.1051E 01	0.1984E 01	0.2134E 01	0.3855E 01	0.7285E 01
1.07	0.	0.	0.1089E 01	0.2057E 01	0.2212E 01	0.3996E 01	0.7551E 01
1.10	0.	0.	0.1128E 01	0.2133E 01	0.2294E 01	0.4144E 01	0.7830E 01
1.20	0.	0.	0.1279E 01	0.2408E 01	0.2589E 01	0.4677E 01	0.8838E 01
1.30	0.	0.	0.1456E 01	0.2714E 01	0.2919E 01	0.5272E 01	0.9962E 01
1.40	0.	0.	0.1659E 01	0.3049E 01	0.3280E 01	0.5924E 01	0.1119E 02
1.50	0.	0.1871E 01	0.1889E 01	0.3413E 01	0.3671E 01	0.6632E 01	0.1253E 02
1.60	0.	0.1895E 01	0.2147E 01	0.3805E 01	0.4092E 01	0.7393E 01	0.1397E 02
1.70	0.	0.1897E 01	0.2431E 01	0.4224E 01	0.4543E 01	0.8206E 01	0.1551E 02
1.80	0.	0.1899E 01	0.2741E 01	0.4670E 01	0.5022E 01	0.9072E 01	0.1714E 02
1.90	0.	0.1900E 01	0.3076E 01	0.5142E 01	0.5530E 01	0.9990E 01	0.1888E 02
2.00	0.	0.1902E 01	0.3436E 01	0.5640E 01	0.6066E 01	0.1096E 02	0.2071E 02
2.20	0.	0.1902E 01	0.4228E 01	0.6716E 01	0.7224E 01	0.1305E 02	0.2466E 02
2.40	0.	0.1901E 01	0.5111E 01	0.7897E 01	0.8493E 01	0.1534E 02	0.2899E 02
2.60	0.	0.1900E 01	0.6082E 01	0.9181E 01	0.9875E 01	0.1784E 02	0.3370E 02
2.80	0.	0.1899E 01	0.7140E 01	0.1057E 02	0.1137E 02	0.2053E 02	0.3880E 02
3.00	0.	0.1898E 01	0.8282E 01	0.1206E 02	0.1297E 02	0.2343E 02	0.4428E 02
3.20	0.	0.1896E 01	0.9507E 01	0.1366E 02	0.1469E 02	0.2653E 02	0.5013E 02
3.40	0.	0.1895E 01	0.1082E 02	0.1535E 02	0.1651E 02	0.2983E 02	0.5637E 02
3.60	0.	0.1894E 01	0.1221E 02	0.1716E 02	0.1845E 02	0.3333E 02	0.6298E 02
3.80	0.	0.1893E 01	0.1368E 02	0.1906E 02	0.2050E 02	0.3703E 02	0.6997E 02
4.00	0.	0.1892E 01	0.1523E 02	0.2107E 02	0.2266E 02	0.4093E 02	0.7734E 02
4.20	0.	0.1892E 01	0.1686E 02	0.2318E 02	0.2493E 02	0.4503E 02	0.8509E 02
4.40	0.	0.1892E 01	0.1858E 02	0.2539E 02	0.2731E 02	0.4934E 02	0.9322E 02
4.60	0.	0.1892E 01	0.2037E 02	0.2771E 02	0.2980E 02	0.5384E 02	0.1017E 03
4.80	0.	0.1892E 01	0.2225E 02	0.3013E 02	0.3241E 02	0.5854E 02	0.1106E 03
5.00	0.	0.1892E 01	0.2421E 02	0.3265E 02	0.3512E 02	0.6344E 02	0.1199E 03

DESIGN JET MACH NUMBER = 1.5

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.	0.1892E 01	0.2421E 02	0.3265E 02	0.3512E 02	0.6344E 02	0.1199E 03
5.50	0.	0.1891E 01	0.2945E 02	0.3941E 02	0.4239E 02	0.7657E 02	0.1447E 03
6.00	0.	0.1891E 01	0.3519E 02	0.4682E 02	0.5035E 02	0.9096E 02	0.1719E 03
6.50	0.	0.1891E 01	0.4144E 02	0.5486E 02	0.5900E 02	0.1066E 03	0.2014E 03
7.00	0.	0.1891E 01	0.4819E 02	0.6355E 02	0.6835E 02	0.1235E 03	0.2333E 03
7.50	0.	0.1891E 01	0.5543E 02	0.7289E 02	0.7839E 02	0.1416E 03	0.2676E 03
8.00	0.	0.1891E 01	0.6318E 02	0.8287E 02	0.8912E 02	0.1610E 03	0.3042E 03
8.50	0.	0.1890E 01	0.7143E 02	0.9349E 02	0.1005E 03	0.1816E 03	0.3432E 03
9.00	0.	0.1890E 01	0.8018E 02	0.1048E 03	0.1127E 03	0.2035E 03	0.3846E 03
9.50	0.	0.1890E 01	0.8943E 02	0.1167E 03	0.1255E 03	0.2267E 03	0.4283E 03
10.00	0.	0.1890E 01	0.9918E 02	0.1292E 03	0.1390E 03	0.2511E 03	0.4744E 03
10.50	0.	0.1890E 01	0.1094E 03	0.1424E 03	0.1532E 03	0.2767E 03	0.5228E 03
11.00	0.	0.1889E 01	0.1202E 03	0.1563E 03	0.1681E 03	0.3036E 03	0.5736E 03
11.50	0.	0.1889E 01	0.1314E 03	0.1707E 03	0.1836E 03	0.3317E 03	0.6268E 03
12.00	0.	0.1889E 01	0.1432E 03	0.1859E 03	0.1999E 03	0.3611E 03	0.6823E 03
12.50	0.	0.1889E 01	0.1554E 03	0.2016E 03	0.2169E 03	0.3918E 03	0.7402E 03
13.00	0.	0.1889E 01	0.1682E 03	0.2181E 03	0.2345E 03	0.4237E 03	0.8005E 03
13.50	0.	0.1889E 01	0.1814E 03	0.2351E 03	0.2529E 03	0.4568E 03	0.8631E 03
14.00	0.	0.1888E 01	0.1952E 03	0.2528E 03	0.2719E 03	0.4912E 03	0.9281E 03
14.50	0.	0.1888E 01	0.2094E 03	0.2712E 03	0.2916E 03	0.5268E 03	0.9955E 03
15.00	0.	0.1888E 01	0.2242E 03	0.2902E 03	0.3121E 03	0.5637E 03	0.1065E 04
15.50	0.	0.1888E 01	0.2394E 03	0.3098E 03	0.3332E 03	0.6019E 03	0.1137E 04
16.00	0.	0.1888E 01	0.2552E 03	0.3301E 03	0.3550E 03	0.6413E 03	0.1212E 04
16.50	0.	0.1888E 01	0.2714E 03	0.3510E 03	0.3775E 03	0.6819E 03	0.1289E 04
17.00	0.	0.1887E 01	0.2882E 03	0.3726E 03	0.4007E 03	0.7238E 03	0.1368E 04
17.50	0.	0.1887E 01	0.3054E 03	0.3948E 03	0.4246E 03	0.7670E 03	0.1449E 04
18.00	0.	0.1887E 01	0.3232E 03	0.4176E 03	0.4492E 03	0.8114E 03	0.1533E 04
18.50	0.	0.1887E 01	0.3414E 03	0.4411E 03	0.4744E 03	0.8570E 03	0.1619E 04
19.00	0.	0.1887E 01	0.3602E 03	0.4653E 03	0.5004E 03	0.9040E 03	0.1708E 04
19.50	0.	0.1886E 01	0.3794E 03	0.4901E 03	0.5271E 03	0.9521E 03	0.1799E 04

DESIGN JET MACH NUMBER = 1.5

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.	0.1886E 01	0.3794E 03	0.4901E 03	0.5271E 03	0.9521E 03	0.1799E 04
20.00	0.	0.1886E 01	0.3992E 03	0.5155E 03	0.5544E 03	0.1002E 04	0.1892E 04
20.50	0.	0.1886E 01	0.4194E 03	0.5416E 03	0.5825E 03	0.1052E 04	0.1988E 04
21.00	0.	0.1886E 01	0.4402E 03	0.5683E 03	0.6112E 03	0.1104E 04	0.2086E 04
21.50	0.	0.1886E 01	0.4614E 03	0.5956E 03	0.6406E 03	0.1157E 04	0.2187E 04
22.00	0.	0.1886E 01	0.4832E 03	0.6236E 03	0.6707E 03	0.1212E 04	0.2289E 04
22.50	0.	0.1885E 01	0.5054E 03	0.6523E 03	0.7015E 03	0.1267E 04	0.2395E 04
23.00	0.	0.1885E 01	0.5282E 03	0.6816E 03	0.7330E 03	0.1324E 04	0.2502E 04
23.50	0.	0.1885E 01	0.5514E 03	0.7115E 03	0.7652E 03	0.1382E 04	0.2612E 04
24.00	0.	0.1885E 01	0.5752E 03	0.7421E 03	0.7981E 03	0.1442E 04	0.2724E 04
24.50	0.	0.1885E 01	0.5994E 03	0.7733E 03	0.8317E 03	0.1502E 04	0.2839E 04
25.00	0.	0.1884E 01	0.6242E 03	0.8052E 03	0.8660E 03	0.1564E 04	0.2956E 04
25.50	0.	0.1884E 01	0.6494E 03	0.8377E 03	0.9010E 03	0.1628E 04	0.3075E 04
26.00	0.	0.1884E 01	0.6752E 03	0.8709E 03	0.9366E 03	0.1692E 04	0.3197E 04
26.50	0.	0.1884E 01	0.7014E 03	0.9046E 03	0.9730E 03	0.1758E 04	0.3321E 04
27.00	0.	0.1884E 01	0.7282E 03	0.9391E 03	0.1010E 04	0.1825E 04	0.3447E 04
27.50	0.	0.1884E 01	0.7554E 03	0.9742E 03	0.1048E 04	0.1893E 04	0.3576E 04
28.00	0.	0.1883E 01	0.7832E 03	0.1010E 04	0.1086E 04	0.1962E 04	0.3707E 04
28.50	0.	0.1883E 01	0.8114E 03	0.1046E 04	0.1125E 04	0.2033E 04	0.3841E 04
29.00	0.	0.1883E 01	0.8402E 03	0.1083E 04	0.1165E 04	0.2105E 04	0.3977E 04
29.50	0.	0.1883E 01	0.8694E 03	0.1121E 04	0.1206E 04	0.2178E 04	0.4115E 04
30.00	0.	0.1883E 01	0.8992E 03	0.1159E 04	0.1247E 04	0.2252E 04	0.4256E 04
30.50	0.	0.1882E 01	0.9294E 03	0.1198E 04	0.1289E 04	0.2328E 04	0.4399E 04
31.00	0.	0.1882E 01	0.9602E 03	0.1238E 04	0.1331E 04	0.2405E 04	0.4544E 04
31.50	0.	0.1882E 01	0.9914E 03	0.1278E 04	0.1375E 04	0.2483E 04	0.4692E 04
32.00	0.	0.1882E 01	0.1023E 04	0.1319E 04	0.1419E 04	0.2562E 04	0.4842E 04
32.50	0.	0.1882E 01	0.1055E 04	0.1360E 04	0.1463E 04	0.2643E 04	0.4994E 04
33.00	0.	0.1882E 01	0.1088E 04	0.1403E 04	0.1509E 04	0.2725E 04	0.5149E 04
33.50	0.	0.1881E 01	0.1121E 04	0.1445E 04	0.1555E 04	0.2808E 04	0.5306E 04
34.00	0.	0.1881E 01	0.1155E 04	0.1489E 04	0.1601E 04	0.2893E 04	0.5466E 04

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 1.8

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.	0.	0.1013E 01	0.1915E 01	0.2357E 01	0.4015E 01	0.1100E 02
1.04	0.	0.	0.1051E 01	0.1984E 01	0.2442E 01	0.4160E 01	0.1140E 02
1.07	0.	0.	0.1089E 01	0.2057E 01	0.2531E 01	0.4312E 01	0.1182E 02
1.10	0.	0.	0.1128E 01	0.2133E 01	0.2624E 01	0.4471E 01	0.1225E 02
1.20	0.	0.	0.1279E 01	0.2408E 01	0.2962E 01	0.5047E 01	0.1383E 02
1.30	0.	0.	0.1456E 01	0.2714E 01	0.3339E 01	0.5688E 01	0.1559E 02
1.40	0.	0.	0.1659E 01	0.3049E 01	0.3752E 01	0.6392E 01	0.1752E 02
1.50	0.	0.1871E 01	0.1889E 01	0.3413E 01	0.4200E 01	0.7155E 01	0.1961E 02
1.60	0.	0.1895E 01	0.2147E 01	0.3805E 01	0.4682E 01	0.7976E 01	0.2186E 02
1.70	0.	0.1897E 01	0.2431E 01	0.4224E 01	0.5197E 01	0.8854E 01	0.2427E 02
1.80	0.	0.1899E 01	0.2741E 01	0.4670E 01	0.5746E 01	0.9788E 01	0.2683E 02
1.90	0.	0.1900E 01	0.3076E 01	0.5142E 01	0.6327E 01	0.1078E 02	0.2954E 02
2.00	0.	0.1902E 01	0.3436E 01	0.5640E 01	0.6941E 01	0.1182E 02	0.3241E 02
2.20	0.	0.1902E 01	0.4228E 01	0.6716E 01	0.8265E 01	0.1408E 02	0.3859E 02
2.40	0.	0.1901E 01	0.5111E 01	0.7897E 01	0.9717E 01	0.1655E 02	0.4537E 02
2.60	0.	0.1900E 01	0.6082E 01	0.9181E 01	0.1130E 02	0.1925E 02	0.5275E 02
2.80	0.	0.1899E 01	0.7140E 01	0.1057E 02	0.1301E 02	0.2216E 02	0.6073E 02
3.00	0.	0.1898E 01	0.8282E 01	0.1206E 02	0.1484E 02	0.2528E 02	0.6930E 02
3.20	0.	0.1896E 01	0.9507E 01	0.1366E 02	0.1680E 02	0.2863E 02	0.7846E 02
3.40	0.	0.1895E 01	0.1082E 02	0.1535E 02	0.1889E 02	0.3219E 02	0.8822E 02
3.60	0.	0.1894E 01	0.1221E 02	0.1716E 02	0.2111E 02	0.3596E 02	0.9857E 02
3.80	0.	0.1893E 01	0.1368E 02	0.1906E 02	0.2345E 02	0.3995E 02	0.1095E 03
4.00	0.	0.1892E 01	0.1523E 02	0.2107E 02	0.2592E 02	0.4416E 02	0.1211E 03
4.20	0.	0.1892E 01	0.1686E 02	0.2318E 02	0.2852E 02	0.4859E 02	0.1332E 03
4.40	0.	0.1892E 01	0.1858E 02	0.2539E 02	0.3125E 02	0.5323E 02	0.1459E 03
4.60	0.	0.1892E 01	0.2037E 02	0.2771E 02	0.3410E 02	0.5809E 02	0.1592E 03
4.80	0.	0.1892E 01	0.2225E 02	0.3013E 02	0.3707E 02	0.6316E 02	0.1731E 03
5.00	0.	0.1892E 01	0.2421E 02	0.3265E 02	0.4018E 02	0.6845E 02	0.1876E 03

DESIGN JET MACH NUMBER = 1.8

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.	0.1892E 01	0.2421E 02	0.3265E 02	0.4018E 02	0.6845E 02	0.1876E 03
5.50	0.	0.1891E 01	0.2945E 02	0.3941E 02	0.4850E 02	0.8262E 02	0.2265E 03
6.00	0.	0.1891E 01	0.3519E 02	0.4682E 02	0.5761E 02	0.9813E 02	0.2690E 03
6.50	0.	0.1891E 01	0.4144E 02	0.5486E 02	0.6751E 02	0.1150E 03	0.3152E 03
7.00	0.	0.1891E 01	0.4819E 02	0.6355E 02	0.7820E 02	0.1332E 03	0.3652E 03
7.50	0.	0.1891E 01	0.5543E 02	0.7289E 02	0.8969E 02	0.1528E 03	0.4188E 03
8.00	0.	0.1891E 01	0.6318E 02	0.8287E 02	0.1020E 03	0.1737E 03	0.4761E 03
8.50	0.	0.1890E 01	0.7143E 02	0.9349E 02	0.1150E 03	0.1960E 03	0.5372E 03
9.00	0.7784E 02	0.1890E 01	0.9866E 02	0.1289E 03	0.1289E 03	0.2196E 03	0.6019E 03
9.50	0.8583E 02	0.1890E 01	0.1100E 03	0.1436E 03	0.1436E 03	0.2446E 03	0.6703E 03
10.00	0.9382E 02	0.1890E 01	0.1220E 03	0.1590E 03	0.1590E 03	0.2709E 03	0.7425E 03
10.50	0.1029E 03	0.1890E 01	0.1346E 03	0.1752E 03	0.1752E 03	0.2985E 03	0.8183E 03
11.00	0.1120E 03	0.1889E 01	0.1479E 03	0.1923E 03	0.1923E 03	0.3275E 03	0.8978E 03
11.50	0.1220E 03	0.1889E 01	0.1617E 03	0.2101E 03	0.2101E 03	0.3579E 03	0.9810E 03
12.00	0.1321E 03	0.1889E 01	0.1762E 03	0.2287E 03	0.2287E 03	0.3896E 03	0.1068E 04
12.50	0.1430E 03	0.1889E 01	0.1912E 03	0.2481E 03	0.2481E 03	0.4227E 03	0.1159E 04
13.00	0.1540E 03	0.1889E 01	0.2069E 03	0.2683E 03	0.2683E 03	0.4571E 03	0.1253E 04
13.50	0.1658E 03	0.1889E 01	0.2232E 03	0.2893E 03	0.2893E 03	0.4929E 03	0.1351E 04
14.00	0.1777E 03	0.1888E 01	0.2402E 03	0.3111E 03	0.3111E 03	0.5300E 03	0.1453E 04
14.50	0.1904E 03	0.1888E 01	0.2577E 03	0.3337E 03	0.3337E 03	0.5684E 03	0.1558E 04
15.00	0.2031E 03	0.1888E 01	0.2758E 03	0.3570E 03	0.3570E 03	0.6082E 03	0.1667E 04
15.50	0.2168E 03	0.1888E 01	0.2946E 03	0.3812E 03	0.3812E 03	0.6494E 03	0.1780E 04
16.00	0.2304E 03	0.1888E 01	0.3140E 03	0.4062E 03	0.4062E 03	0.6919E 03	0.1897E 04
16.50	0.2449E 03	0.1888E 01	0.3340E 03	0.4319E 03	0.4319E 03	0.7358E 03	0.2017E 04
17.00	0.2594E 03	0.1887E 01	0.3546E 03	0.4584E 03	0.4584E 03	0.7810E 03	0.2141E 04
17.50	0.2748E 03	0.1887E 01	0.3758E 03	0.4858E 03	0.4858E 03	0.8275E 03	0.2268E 04
18.00	0.2902E 03	0.1887E 01	0.3977E 03	0.5139E 03	0.5139E 03	0.8754E 03	0.2400E 04
18.50	0.3065E 03	0.1887E 01	0.4201E 03	0.5428E 03	0.5428E 03	0.9247E 03	0.2535E 04
19.00	0.3228E 03	0.1887E 01	0.4432E 03	0.5725E 03	0.5725E 03	0.9753E 03	0.2673E 04
19.50	0.3399E 03	0.1886E 01	0.4669E 03	0.6030E 03	0.6030E 03	0.1027E 04	0.2816E 04

DESIGN JET MACH NUMBER = 1.8

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.3399E 03	0.1886E 01	0.4669E 03	0.6030E 03	0.6030E 03	0.1027E 04	0.2816E 04
20.00	0.3571E 03	0.1886E 01	0.4912E 03	0.6343E 03	0.6343E 03	0.1081E 04	0.2962E 04
20.50	0.3751E 03	0.1886E 01	0.5161E 03	0.6664E 03	0.6664E 03	0.1135E 04	0.3112E 04
21.00	0.3932E 03	0.1886E 01	0.5416E 03	0.6993E 03	0.6993E 03	0.1191E 04	0.3265E 04
21.50	0.4121E 03	0.1886E 01	0.5678E 03	0.7329E 03	0.7329E 03	0.1249E 04	0.3422E 04
22.00	0.4310E 03	0.1886E 01	0.5945E 03	0.7674E 03	0.7674E 03	0.1307E 04	0.3583E 04
22.50	0.4509E 03	0.1885E 01	0.6219E 03	0.8026E 03	0.8026E 03	0.1367E 04	0.3748E 04
23.00	0.4707E 03	0.1885E 01	0.6499E 03	0.8387E 03	0.8387E 03	0.1429E 04	0.3916E 04
23.50	0.4914E 03	0.1885E 01	0.6785E 03	0.8755E 03	0.8755E 03	0.1491E 04	0.4088E 04
24.00	0.5121E 03	0.1885E 01	0.7077E 03	0.9131E 03	0.9131E 03	0.1556E 04	0.4264E 04
24.50	0.5336E 03	0.1885E 01	0.7376E 03	0.9516E 03	0.9516E 03	0.1621E 04	0.4443E 04
25.00	0.5552E 03	0.1884E 01	0.7680E 03	0.9908E 03	0.9908E 03	0.1688E 04	0.4626E 04
25.50	0.5777E 03	0.1884E 01	0.7991E 03	0.1031E 04	0.1031E 04	0.1756E 04	0.4813E 04
26.00	0.6001E 03	0.1884E 01	0.8308E 03	0.1072E 04	0.1072E 04	0.1825E 04	0.5004E 04
26.50	0.6234E 03	0.1884E 01	0.8631E 03	0.1113E 04	0.1113E 04	0.1896E 04	0.5198E 04
27.00	0.6468E 03	0.1884E 01	0.8960E 03	0.1156E 04	0.1156E 04	0.1969E 04	0.5396E 04
27.50	0.6710E 03	0.1884E 01	0.9295E 03	0.1199E 04	0.1199E 04	0.2042E 04	0.5597E 04
28.00	0.6952E 03	0.1883E 01	0.9637E 03	0.1243E 04	0.1243E 04	0.2117E 04	0.5803E 04
28.50	0.7203E 03	0.1883E 01	0.9984E 03	0.1287E 04	0.1287E 04	0.2193E 04	0.6012E 04
29.00	0.7454E 03	0.1883E 01	0.1034E 04	0.1333E 04	0.1333E 04	0.2271E 04	0.6224E 04
29.50	0.7714E 03	0.1883E 01	0.1070E 04	0.1379E 04	0.1379E 04	0.2350E 04	0.6441E 04
30.00	0.7974E 03	0.1883E 01	0.1106E 04	0.1426E 04	0.1426E 04	0.2430E 04	0.6661E 04
30.50	0.8242E 03	0.1882E 01	0.1144E 04	0.1474E 04	0.1474E 04	0.2512E 04	0.6885E 04
31.00	0.8511E 03	0.1882E 01	0.1181E 04	0.1523E 04	0.1523E 04	0.2595E 04	0.7112E 04
31.50	0.8788E 03	0.1882E 01	0.1220E 04	0.1573E 04	0.1573E 04	0.2679E 04	0.7343E 04
32.00	0.9066E 03	0.1882E 01	0.1259E 04	0.1623E 04	0.1623E 04	0.2765E 04	0.7578E 04
32.50	0.9352E 03	0.1882E 01	0.1299E 04	0.1674E 04	0.1674E 04	0.2852E 04	0.7817E 04
33.00	0.9638E 03	0.1882E 01	0.1339E 04	0.1726E 04	0.1726E 04	0.2940E 04	0.8059E 04
33.50	0.9933E 03	0.1881E 01	0.1380E 04	0.1779E 04	0.1779E 04	0.3030E 04	0.8305E 04
34.00	0.1023E 04	0.1881E 01	0.1421E 04	0.1832E 04	0.1832E 04	0.3121E 04	0.8555E 04

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 2.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.	0.	0.1013E 01	0.1915E 01	0.2657E 01	0.4361E 01	0.1499E 02
1.04	0.	0.	0.1051E 01	0.1984E 01	0.2753E 01	0.4518E 01	0.1553E 02
1.07	0.	0.	0.1089E 01	0.2057E 01	0.2854E 01	0.4684E 01	0.1610E 02
1.10	0.	0.	0.1128E 01	0.2133E 01	0.2959E 01	0.4856E 01	0.1669E 02
1.20	0.	0.	0.1279E 01	0.2408E 01	0.3340E 01	0.5482E 01	0.1884E 02
1.30	0.	0.	0.1456E 01	0.2714E 01	0.3764E 01	0.6179E 01	0.2123E 02
1.40	0.	0.	0.1659E 01	0.3049E 01	0.4230E 01	0.6943E 01	0.2386E 02
1.50	0.	0.1871E 01	0.1889E 01	0.3413E 01	0.4735E 01	0.7772E 01	0.2671E 02
1.60	0.	0.1895E 01	0.2147E 01	0.3805E 01	0.5278E 01	0.8663E 01	0.2977E 02
1.70	0.	0.1897E 01	0.2431E 01	0.4224E 01	0.5859E 01	0.9617E 01	0.3305E 02
1.80	0.	0.1899E 01	0.2741E 01	0.4670E 01	0.6478E 01	0.1063E 02	0.3654E 02
1.90	0.	0.1900E 01	0.3076E 01	0.5142E 01	0.7133E 01	0.1171E 02	0.4023E 02
2.00	0.	0.1902E 01	0.3436E 01	0.5640E 01	0.7824E 01	0.1284E 02	0.4413E 02
2.20	0.	0.1902E 01	0.4228E 01	0.6716E 01	0.9317E 01	0.1529E 02	0.5255E 02
2.40	0.	0.1901E 01	0.5111E 01	0.7897E 01	0.1095E 02	0.1798E 02	0.6179E 02
2.60	0.	0.1900E 01	0.6082E 01	0.9181E 01	0.1274E 02	0.2090E 02	0.7184E 02
2.80	0.	0.1899E 01	0.7140E 01	0.1057E 02	0.1466E 02	0.2407E 02	0.8270E 02
3.00	0.	0.1898E 01	0.8282E 01	0.1206E 02	0.1673E 02	0.2746E 02	0.9437E 02
3.20	0.	0.1896E 01	0.9507E 01	0.1366E 02	0.1894E 02	0.3109E 02	0.1069E 03
3.40	0.	0.1895E 01	0.1082E 02	0.1535E 02	0.2130E 02	0.3496E 02	0.1201E 03
3.60	0.1113E 02	0.1894E 01	0.1693E 02	0.2380E 02	0.2380E 02	0.3906E 02	0.1342E 03
3.80	0.1187E 02	0.1893E 01	0.1897E 02	0.2644E 02	0.2644E 02	0.4340E 02	0.1491E 03
4.00	0.1273E 02	0.1892E 01	0.2113E 02	0.2923E 02	0.2923E 02	0.4797E 02	0.1648E 03
4.20	0.1367E 02	0.1892E 01	0.2339E 02	0.3215E 02	0.3215E 02	0.5278E 02	0.1814E 03
4.40	0.1467E 02	0.1892E 01	0.2577E 02	0.3523E 02	0.3523E 02	0.5782E 02	0.1987E 03
4.60	0.1573E 02	0.1892E 01	0.2826E 02	0.3844E 02	0.3844E 02	0.6309E 02	0.2168E 03
4.80	0.1684E 02	0.1892E 01	0.3087E 02	0.4180E 02	0.4180E 02	0.6860E 02	0.2358E 03
5.00	0.1801E 02	0.1892E 01	0.3358E 02	0.4530E 02	0.4530E 02	0.7435E 02	0.2555E 03

DESIGN JET MACH NUMBER = 2.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1801E 02	0.1892E 01	0.3358E 02	0.4530E 02	0.4530E 02	0.7435E 02	0.2555E 03
5.50	0.2132E 02	0.1891E 01	0.4085E 02	0.5467E 02	0.5467E 02	0.8974E 02	0.3084E 03
6.00	0.2464E 02	0.1891E 01	0.4882E 02	0.6494E 02	0.6494E 02	0.1066E 03	0.3663E 03
6.50	0.2857E 02	0.1891E 01	0.5749E 02	0.7610E 02	0.7610E 02	0.1249E 03	0.4293E 03
7.00	0.3250E 02	0.1891E 01	0.6684E 02	0.8816E 02	0.8816E 02	0.1447E 03	0.4973E 03
7.50	0.3705E 02	0.1891E 01	0.7690E 02	0.1011E 03	0.1011E 03	0.1660E 03	0.5703E 03
8.00	0.4160E 02	0.1891E 01	0.8765E 02	0.1150E 03	0.1150E 03	0.1887E 03	0.6484E 03
8.50	0.4676E 02	0.1890E 01	0.9909E 02	0.1297E 03	0.1297E 03	0.2129E 03	0.7315E 03
9.00	0.5191E 02	0.1890E 01	0.1112E 03	0.1453E 03	0.1453E 03	0.2385E 03	0.8196E 03
9.50	0.5768E 02	0.1890E 01	0.1241E 03	0.1618E 03	0.1618E 03	0.2656E 03	0.9128E 03
10.00	0.6345E 02	0.1890E 01	0.1376E 03	0.1793E 03	0.1793E 03	0.2942E 03	0.1011E 04
10.50	0.6982E 02	0.1890E 01	0.1518E 03	0.1976E 03	0.1976E 03	0.3243E 03	0.1114E 04
11.00	0.7620E 02	0.1889E 01	0.1667E 03	0.2168E 03	0.2168E 03	0.3558E 03	0.1223E 04
11.50	0.8318E 02	0.1889E 01	0.1823E 03	0.2369E 03	0.2369E 03	0.3888E 03	0.1336E 04
12.00	0.9016E 02	0.1889E 01	0.1986E 03	0.2578E 03	0.2578E 03	0.4232E 03	0.1454E 04
12.50	0.9776E 02	0.1889E 01	0.2156E 03	0.2797E 03	0.2797E 03	0.4591E 03	0.1578E 04
13.00	0.1053E 03	0.1889E 01	0.2333E 03	0.3025E 03	0.3025E 03	0.4965E 03	0.1706E 04
13.50	0.1135E 03	0.1889E 01	0.2517E 03	0.3262E 03	0.3262E 03	0.5353E 03	0.1840E 04
14.00	0.1217E 03	0.1888E 01	0.2707E 03	0.3507E 03	0.3507E 03	0.5756E 03	0.1978E 04
14.50	0.1306E 03	0.1888E 01	0.2905E 03	0.3762E 03	0.3762E 03	0.6174E 03	0.2122E 04
15.00	0.1394E 03	0.1888E 01	0.3110E 03	0.4025E 03	0.4025E 03	0.6607E 03	0.2270E 04
15.50	0.1488E 03	0.1888E 01	0.3321E 03	0.4298E 03	0.4298E 03	0.7054E 03	0.2424E 04
16.00	0.1582E 03	0.1888E 01	0.3540E 03	0.4579E 03	0.4579E 03	0.7515E 03	0.2583E 04
16.50	0.1682E 03	0.1888E 01	0.3765E 03	0.4869E 03	0.4869E 03	0.7992E 03	0.2746E 04
17.00	0.1782E 03	0.1887E 01	0.3998E 03	0.5168E 03	0.5168E 03	0.8483E 03	0.2915E 04
17.50	0.1889E 03	0.1887E 01	0.4237E 03	0.5476E 03	0.5476E 03	0.8989E 03	0.3089E 04
18.00	0.1995E 03	0.1887E 01	0.4483E 03	0.5793E 03	0.5793E 03	0.9509E 03	0.3268E 04
18.50	0.2107E 03	0.1887E 01	0.4736E 03	0.6119E 03	0.6119E 03	0.1004E 04	0.3452E 04
19.00	0.2220E 03	0.1887E 01	0.4996E 03	0.6454E 03	0.6454E 03	0.1059E 04	0.3640E 04
19.50	0.2333E 03	0.1886E 01	0.5263E 03	0.6798E 03	0.6798E 03	0.1116E 04	0.3834E 04

DESIGN JET MACH NUMBER = 2.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.2338E 03	0.1886E 01	0.5263E 03	0.6798E 03	0.6798E 03	0.1116E 04	0.3834E 04
20.00	0.2456E 03	0.1886E 01	0.5537E 03	0.7151E 03	0.7151E 03	0.1174E 04	0.4033E 04
20.50	0.2581E 03	0.1886E 01	0.5818E 03	0.7513E 03	0.7513E 03	0.1233E 04	0.4237E 04
21.00	0.2706E 03	0.1886E 01	0.6106E 03	0.7883E 03	0.7883E 03	0.1294E 04	0.4446E 04
21.50	0.2836E 03	0.1886E 01	0.6401E 03	0.8263E 03	0.8263E 03	0.1356E 04	0.4661E 04
22.00	0.2967E 03	0.1886E 01	0.6703E 03	0.8651E 03	0.8651E 03	0.1420E 04	0.4880E 04
22.50	0.3103E 03	0.1885E 01	0.7011E 03	0.9049E 03	0.9049E 03	0.1485E 04	0.5104E 04
23.00	0.3240E 03	0.1885E 01	0.7327E 03	0.9455E 03	0.9455E 03	0.1552E 04	0.5333E 04
23.50	0.3383E 03	0.1885E 01	0.7649E 03	0.9870E 03	0.9870E 03	0.1620E 04	0.5567E 04
24.00	0.3526E 03	0.1885E 01	0.7979E 03	0.1029E 04	0.1029E 04	0.1690E 04	0.5806E 04
24.50	0.3674E 03	0.1885E 01	0.8315E 03	0.1073E 04	0.1073E 04	0.1761E 04	0.6051E 04
25.00	0.3823E 03	0.1884E 01	0.8658E 03	0.1117E 04	0.1117E 04	0.1833E 04	0.6300E 04
25.50	0.3978E 03	0.1884E 01	0.9009E 03	0.1162E 04	0.1162E 04	0.1907E 04	0.6555E 04
26.00	0.4133E 03	0.1884E 01	0.9366E 03	0.1208E 04	0.1208E 04	0.1983E 04	0.6814E 04
26.50	0.4294E 03	0.1884E 01	0.9730E 03	0.1255E 04	0.1255E 04	0.2060E 04	0.7078E 04
27.00	0.4455E 03	0.1884E 01	0.1010E 04	0.1303E 04	0.1303E 04	0.2138E 04	0.7348E 04
27.50	0.4622E 03	0.1884E 01	0.1048E 04	0.1351E 04	0.1351E 04	0.2218E 04	0.7622E 04
28.00	0.4789E 03	0.1883E 01	0.1086E 04	0.1401E 04	0.1401E 04	0.2299E 04	0.7902E 04
28.50	0.4962E 03	0.1883E 01	0.1126E 04	0.1451E 04	0.1451E 04	0.2382E 04	0.8187E 04
29.00	0.5135E 03	0.1883E 01	0.1165E 04	0.1503E 04	0.1503E 04	0.2467E 04	0.8476E 04
29.50	0.5314E 03	0.1883E 01	0.1206E 04	0.1555E 04	0.1555E 04	0.2552E 04	0.8771E 04
30.00	0.5493E 03	0.1883E 01	0.1247E 04	0.1608E 04	0.1608E 04	0.2639E 04	0.9071E 04
30.50	0.5679E 03	0.1882E 01	0.1289E 04	0.1662E 04	0.1662E 04	0.2728E 04	0.9375E 04
31.00	0.5864E 03	0.1882E 01	0.1332E 04	0.1717E 04	0.1717E 04	0.2818E 04	0.9685E 04
31.50	0.6055E 03	0.1882E 01	0.1375E 04	0.1773E 04	0.1773E 04	0.2910E 04	1.0000E 04
32.00	0.6247E 03	0.1882E 01	0.1419E 04	0.1830E 04	0.1830E 04	0.3003E 04	0.1032E 05
32.50	0.6444E 03	0.1882E 01	0.1464E 04	0.1887E 04	0.1887E 04	0.3098E 04	0.1064E 05
33.00	0.6641E 03	0.1882E 01	0.1510E 04	0.1946E 04	0.1946E 04	0.3194E 04	0.1097E 05
33.50	0.6845E 03	0.1881E 01	0.1556E 04	0.2005E 04	0.2005E 04	0.3291E 04	0.1131E 05
34.00	0.7048E 03	0.1881E 01	0.1602E 04	0.2065E 04	0.2065E 04	0.3390E 04	0.1165E 05

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 3.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.	0.	0.1013E 01	0.1915E 01	0.5833E 01	0.8495E 01	0.7035E 02
1.04	0.	0.	0.1051E 01	0.1984E 01	0.6044E 01	0.8802E 01	0.7289E 02
1.07	0.	0.	0.1089E 01	0.2057E 01	0.6265E 01	0.9124E 01	0.7556E 02
1.10	0.	0.	0.1128E 01	0.2133E 01	0.6496E 01	0.9460E 01	0.7835E 02
1.20	0.	0.	0.1279E 01	0.2408E 01	0.7332E 01	0.1068E 02	0.8843E 02
1.30	0.	0.	0.1456E 01	0.2714E 01	0.8264E 01	0.1204E 02	0.9968E 02
1.40	0.	0.	0.1659E 01	0.3049E 01	0.9287E 01	0.1352E 02	0.1120E 03
1.50	0.	0.1871E 01	0.1889E 01	0.3413E 01	0.1040E 02	0.1514E 02	0.1254E 03
1.60	0.1984E 01	0.1895E 01	0.6539E 01	0.1159E 02	0.1159E 02	0.1688E 02	0.1398E 03
1.70	0.1989E 01	0.1897E 01	0.7404E 01	0.1286E 02	0.1286E 02	0.1873E 02	0.1552E 03
1.80	0.1994E 01	0.1899E 01	0.8348E 01	0.1422E 02	0.1422E 02	0.2071E 02	0.1715E 03
1.90	0.2018E 01	0.1900E 01	0.9369E 01	0.1566E 02	0.1566E 02	0.2281E 02	0.1889E 03
2.00	0.2052E 01	0.1902E 01	0.1047E 02	0.1718E 02	0.1718E 02	0.2502E 02	0.2072E 03
2.20	0.2138E 01	0.1902E 01	0.123[illegible]E 02	0.20[illegible]6E 02	0.2046E 02	0.2979E 02	0.2467E 03
2.40	0.2238E 01	0.1901E 01	0.1557E 02	0.2405E 02	0.2[illegible]05E 02	0.3503E 02	0.2901E 03
2.60	0.2350E 01	0.1900E 01	0.1852E 02	0.2796E 02	0.2796E 02	0.4072E 02	0.3373E 03
2.80	0.2470E 01	0.1899E 01	0.2174E 02	0.3219E 02	0.3219E 02	0.4688E 02	0.3[illegible]82E 03
3.00	0.2598E 01	0.1898E 01	0.2522E 02	0.3673E 02	0.3673E 02	0.5350E 02	0.4430E 03
3.20	0.2734E 01	0.1896E 01	0.2896E 02	0.4159E 02	0.4159E 02	0.6057E 02	0.5016E 03
3.40	0.2877E 01	0.1895E 01	0.3294E 02	0.4676E 02	0.4676E 02	0.6810E 02	0.5640E 03
3.60	0.3027E 01	0.1894E 01	0.3717E 02	0.5225E 02	0.5225E 02	0.7609E 02	0.6302E 03
3.80	0.3183E 01	0.1893E 01	0.4165E 02	0.5805E 02	0.5805E 02	0.8454E 02	0.7001E 03
4.00	0.3346E 01	0.1892E 01	0.4638E 02	0.6416E 02	0.6416E 02	0.9345E 02	0.7739E 03
4.20	0.3516E 01	0.1892E 01	0.5136E 02	0.7059E 02	0.7059E 02	0.1028E 03	0.8514E 03
4.40	0.3693E 01	0.1892E 01	0.5658E 02	0.7734E 02	0.7734E 02	0.1126E 03	0.9328E 03
4.60	0.3876E 01	0.1892E 01	0.6205E 02	0.8439E 02	0.8439E 02	0.1229E 03	0.1018E 04
4.80	0.4067E 01	0.1892E 01	0.6776E 02	0.9176E 02	0.9176E 02	0.1336E 03	0.1107E 04
5.00	0.4264E 01	0.1892E 01	0.7372E 02	0.9945E 02	0.9945E 02	0.1448E 03	0.1199E 04

DESIGN JET MACH NUMBER = 3.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.4264E 01	0.1892E 01	0.7372E 02	0.9945E 02	0.9945E 02	0.1448E 03	0.1199E 04
5.50	0.4808E 01	0.1891E 01	0.8969E 02	0.1200E 03	0.1200E 03	0.1748E 03	0.1448E 04
6.00	0.5352E 01	0.1891E 01	0.1072E 03	0.1426E 03	0.1426E 03	0.2076E 03	0.1720E 04
6.50	0.5984E 01	0.1891E 01	0.1262E 03	0.1671E 03	0.1671E 03	0.2433E 03	0.2015E 04
7.00	0.6615E 01	0.1891E 01	0.1468E 03	0.1936E 03	0.1936E 03	0.2819E 03	0.2334E 04
7.50	0.7336E 01	0.1891E 01	0.1688E 03	0.2220E 03	0.2220E 03	0.3233E 03	0.2677E 04
8.00	0.8056E 01	0.1891E 01	0.1924E 03	0.2524E 03	0.2524E 03	0.3675E 03	0.3044E 04
8.50	0.8867E 01	0.1890E 01	0.2175E 03	0.2847E 03	0.2847E 03	0.4147E 03	0.3434E 04
9.00	0.9678E 01	0.1890E 01	0.2442E 03	0.3190E 03	0.3190E 03	0.4646E 03	0.3848E 04
9.50	0.1058E 02	0.1890E 01	0.2724E 03	0.3553E 03	0.3553E 03	0.5174E 03	0.4285E 04
10.00	0.1148E 02	0.1890E 01	0.3021E 03	0.3935E 03	0.3935E 03	0.5731E 03	0.4746E 04
10.50	0.1248E 02	0.1890E 01	0.3333E 03	0.4337E 03	0.4337E 03	0.6317E 03	0.5231E 04
11.00	0.1347E 02	0.1889E 01	0.3660E 03	0.4759E 03	0.4759E 03	0.6931E 03	0.5740E 04
11.50	0.1456E 02	0.1889E 01	0.4003E 03	0.5200E 03	0.5200E 03	0.7573E 03	0.6272E 04
12.00	0.1564E 02	0.1889E 01	0.4360E 03	0.5661E 03	0.5661E 03	0.8244E 03	0.6827E 04
12.50	0.1682E 02	0.1889E 01	0.4734E 03	0.6141E 03	0.6141E 03	0.8944E 03	0.7407E 04
13.00	0.1800E 02	0.1889E 01	0.5122E 03	0.6641E 03	0.6641E 03	0.9672E 03	0.8010E 04
13.50	0.1927E 02	0.1889E 01	0.5525E 03	0.7161E 03	0.7161E 03	0.1043E 04	0.8637E 04
14.00	0.2054E 02	0.1888E 01	0.5944E 03	0.7700E 03	0.7700E 03	0.1121E 04	0.9287E 04
14.50	0.2191E 02	0.1888E 01	0.6378E 03	0.8259E 03	0.8259E 03	0.1203E 04	0.9961E 04
15.00	0.2327E 02	0.1888E 01	0.6827E 03	0.8837E 03	0.8837E 03	0.1287E 04	0.1066E 05
15.50	0.2473E 02	0.1888E 01	0.7292E 03	0.9435E 03	0.9435E 03	0.1374E 04	0.1138E 05
16.00	0.2619E 02	0.1888E 01	0.7771E 03	0.1005E 04	0.1005E 04	0.1464E 04	0.1212E 05
16.50	0.2774E 02	0.1888E 01	0.8266E 03	0.1069E 04	0.1069E 04	0.1557E 04	0.1289E 05
17.00	0.2930E 02	0.1887E 01	0.8776E 03	0.1135E 04	0.1135E 04	0.1652E 04	0.1369E 05
17.50	0.3094E 02	0.1887E 01	0.9302E 03	0.1202E 04	0.1202E 04	0.1751E 04	0.1450E 05
18.00	0.3259E 02	0.1887E 01	0.9842E 03	0.1272E 04	0.1272E 04	0.1852E 04	0.1534E 05
18.50	0.3432E 02	0.1887E 01	0.1040E 04	0.1343E 04	0.1343E 04	0.1957E 04	0.1620E 05
19.00	0.3606E 02	0.1887E 01	0.1097E 04	0.1417E 04	0.1417E 04	0.2064E 04	0.1709E 05
19.50	0.3790E 02	0.1886E 01	0.1156E 04	0.1493E 04	0.1493E 04	0.2174E 04	0.1800E 05

DESIGN JET MACH NUMBER = 3.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.3790E 02	0.1886E 01	0.1156E 04	0.1493E 04	0.1493E 04	0.2174E 04	0.1800E 05
20.00	0.3973E 02	0.1886E 01	0.1216E 04	0.1570E 04	0.1570E 04	0.2286E 04	0.1894E 05
20.50	0.4166E 02	0.1886E 01	0.1277E 04	0.1649E 04	0.1649E 04	0.2402E 04	0.1989E 05
21.00	0.4358E 02	0.1886E 01	0.1341E 04	0.1731E 04	0.1731E 04	0.2521E 04	0.2087E 05
21.50	0.4560E 02	0.1886E 01	0.1405E 04	0.1814E 04	0.1814E 04	0.2642E 04	0.2188E 05
22.00	0.4762E 02	0.1886E 01	0.1472E 04	0.1899E 04	0.1899E 04	0.2766E 04	0.2291E 05
22.50	0.4974E 02	0.1885E 01	0.1539E 04	0.1987E 04	0.1987E 04	0.2893E 04	0.2396E 05
23.00	0.5185E 02	0.1885E 01	0.1609E 04	0.2076E 04	0.2076E 04	0.3023E 04	0.2504E 05
23.50	0.5406E 02	0.1885E 01	0.1679E 04	0.2167E 04	0.2167E 04	0.3156E 04	0.2614E 05
24.00	0.5627E 02	0.1885E 01	0.1752E 04	0.2260E 04	0.2260E 04	0.3291E 04	0.2726E 05
24.50	0.5857E 02	0.1885E 01	0.1826E 04	0.2355E 04	0.2355E 04	0.3430E 04	0.2841E 05
25.00	0.6087E 02	0.1884E 01	0.1901E 04	0.2452E 04	0.2452E 04	0.3571E 04	0.2958E 05
25.50	0.6326E 02	0.1884E 01	0.1978E 04	0.2551E 04	0.2551E 04	0.3716E 04	0.3077E 05
26.00	0.6566E 02	0.1884E 01	0.2056E 04	0.2652E 04	0.2652E 04	0.3863E 04	0.3199E 05
26.50	0.6815E 02	0.1884E 01	0.2136E 04	0.2755E 04	0.2755E 04	0.4012E 04	0.3323E 05
27.00	0.7064E 02	0.1884E 01	0.2218E 04	0.2860E 04	0.2860E 04	0.4165E 04	0.3450E 05
27.50	0.7322E 02	0.1884E 01	0.2301E 04	0.2967E 04	0.2967E 04	0.4321E 04	0.3578E 05
28.00	0.7580E 02	0.1883E 01	0.2385E 04	0.3076E 04	0.3076E 04	0.4479E 04	0.3710E 05
28.50	0.7848E 02	0.1883E 01	0.2471E 04	0.3187E 04	0.3187E 04	0.4641E 04	0.3843E 05
29.00	0.8116E 02	0.1883E 01	0.2559E 04	0.3299E 04	0.3299E 04	0.4805E 04	0.3979E 05
29.50	0.8393E 02	0.1883E 01	0.2648E 04	0.3414E 04	0.3414E 04	0.4972E 04	0.4118E 05
30.00	0.8670E 02	0.1883E 01	0.2738E 04	0.3531E 04	0.3531E 04	0.5142E 04	0.4258E 05
30.50	0.8956E 02	0.1882E 01	0.2831E 04	0.3649E 04	0.3649E 04	0.5315E 04	0.4401E 05
31.00	0.9243E 02	0.1882E 01	0.2924E 04	0.3770E 04	0.3770E 04	0.5490E 04	0.4547E 05
31.50	0.9538E 02	0.1882E 01	0.3019E 04	0.3892E 04	0.3892E 04	0.5669E 04	0.4695E 05
32.00	0.9834E 02	0.1882E 01	0.3116E 04	0.4017E 04	0.4017E 04	0.5850E 04	0.4845E 05
32.50	0.1014E 03	0.1882E 01	0.3214E 04	0.4143E 04	0.4143E 04	0.6034E 04	0.4997E 05
33.00	0.1044E 03	0.1882E 01	0.3314E 04	0.4272E 04	0.4272E 04	0.6221E 04	0.5152E 05
33.50	0.1076E 03	0.1881E 01	0.3415E 04	0.4402E 04	0.4402E 04	0.6411E 04	0.5309E 05
34.00	0.1107E 03	0.1881E 01	0.3518E 04	0.4535E 04	0.4535E 04	0.6604E 04	0.5469E 05

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 4.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.	0.	0.1013E 01	0.1915E 01	0.1380E 02	0.1909E 02	0.2908E 03
1.04	0.	0.	0.1051E 01	0.1984E 01	0.1430E 02	0.1978E 02	0.3013E 03
1.07	0.	0.	0.1089E 01	0.2057E 01	0.1482E 02	0.2051E 02	0.3123E 03
1.10	0.	0.	0.1128E 01	0.2133E 01	0.1537E 02	0.2126E 02	0.3238E 03
1.20	0.	0.	0.1279E 01	0.2408E 01	0.1735E 02	0.2400E 02	0.3655E 03
1.30	0.1342E 01	0.	0.1049E 02	0.1956E 02	0.1956E 02	0.2705E 02	0.4120E 03
1.40	0.1307E 01	0.	0.1196E 02	0.2198E 02	0.2198E 02	0.3040E 02	0.4630E 03
1.50	0.1301E 01	0.1345E 02	0.1362E 02	0.2460E 02	0.2460E 02	0.3403E 02	0.5183E 03
1.60	0.1303E 01	0.1366E 02	0.1547E 02	0.2742E 02	0.2742E 02	0.3793E 02	0.5777E 03
1.70	0.1309E 01	0.1367E 02	0.1752E 02	0.3044E 02	0.3044E 02	0.4211E 02	0.6413E 03
1.80	0.1318E 01	0.1368E 02	0.1975E 02	0.3365E 02	0.3365E 02	0.4655E 02	0.7090E 03
1.90	0.1328E 01	0.1370E 02	0.2217E 02	0.3706E 02	0.3706E 02	0.5126E 02	0.7807E 03
2.00	0.1340E 01	0.1371E 02	0.2477E 02	0.4065E 02	0.4065E 02	0.5623E 02	0.8564E 03
2.20	0.1367E 01	0.1371E 02	0.3047E 02	0.4840E 02	0.4840E 02	0.6696E 02	0.1020E 04
2.40	0.1395E 01	0.1370E 02	0.3683E 02	0.5691E 02	0.5691E 02	0.7873E 02	0.1199E 04
2.60	0.1426E 01	0.1369E 02	0.4383E 02	0.6617E 02	0.6617E 02	0.9153E 02	0.1394E 04
2.80	0.1458E 01	0.1368E 02	0.5145E 02	0.7617E 02	0.7617E 02	0.1054E 03	0.1605E 04
3.00	0.1491E 01	0.1368E 02	0.5969E 02	0.8692E 02	0.8692E 02	0.1202E 03	0.1831E 04
3.20	0.1526E 01	0.1367E 02	0.6852E 02	0.9842E 02	0.9842E 02	0.1361E 03	0.2073E 04
3.40	0.1561E 01	0.1366E 02	0.7794E 02	0.1107E 03	0.1107E 03	0.1531E 03	0.2331E 04
3.60	0.1597E 01	0.1365E 02	0.8796E 02	0.1236E 03	0.1236E 03	0.1710E 03	0.2605E 04
3.80	0.1635E 01	0.1364E 02	0.9857E 02	0.1374E 03	0.1374E 03	0.1900E 03	0.2894E 04
4.00	0.1673E 01	0.1364E 02	0.1098E 03	0.1518E 03	0.1518E 03	0.2100E 03	0.3199E 04
4.20	0.1712E 01	0.1363E 02	0.1215E 03	0.1670E 03	0.1670E 03	0.2311E 03	0.3519E 04
4.40	0.1752E 01	0.1363E 02	0.1339E 03	0.1830E 03	0.1830E 03	0.2532E 03	0.3856E 04
4.60	0.1793E 01	0.1363E 02	0.1468E 03	0.1997E 03	0.1997E 03	0.2763E 03	0.4207E 04
4.80	0.1835E 01	0.1363E 02	0.1604E 03	0.2171E 03	0.2171E 03	0.3004E 03	0.4575E 04
5.00	0.1878E 01	0.1363E 02	0.1745E 03	0.2353E 03	0.2353E 03	0.3255E 03	0.4958E 04

DESIGN JET MACH NUMBER = 4.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1878E 01	0.1363E 02	0.1745E 03	0.2353E 03	0.2353E 03	0.3255E 03	0.4958E 04
5.50	0.1991E 01	0.1891E 01	0.2122E 03	0.2840E 03	0.2840E 03	0.3929E 03	0.5984E 04
6.00	0.2104E 01	0.1891E 01	0.2536E 03	0.3374E 03	0.3374E 03	0.4667E 03	0.7108E 04
6.50	0.2229E 01	0.1891E 01	0.2987E 03	0.3954E 03	0.3954E 03	0.5470E 03	0.8330E 04
7.00	0.2353E 01	0.1891E 01	0.3473E 03	0.4580E 03	0.4580E 03	0.6336E 03	0.9650E 04
7.50	0.2489E 01	0.1891E 01	0.3995E 03	0.5253E 03	0.5253E 03	0.7267E 03	0.1107E 05
8.00	0.2624E 01	0.1891E 01	0.4553E 03	0.5972E 03	0.5972E 03	0.8261E 03	0.1258E 05
8.50	0.2772E 01	0.1890E 01	0.5148E 03	0.6738E 03	0.6738E 03	0.9320E 03	0.1419E 05
9.00	0.2919E 01	0.1890E 01	0.5778E 03	0.7549E 03	0.7549E 03	0.1044E 04	0.1591E 05
9.50	0.3078E 01	0.1890E 01	0.6445E 03	0.8408E 03	0.8408E 03	0.1163E 04	0.1771E 05
10.00	0.3238E 01	0.1890E 01	0.7148E 03	0.9313E 03	0.9313E 03	0.1288E 04	0.1962E 05
10.50	0.3409E 01	0.1890E 01	0.7886E 03	0.1026E 04	0.1026E 04	0.1420E 04	0.2162E 05
11.00	0.3581E 01	0.1889E 01	0.8661E 03	0.1126E 04	0.1126E 04	0.1558E 04	0.2373E 05
11.50	0.3765E 01	0.1889E 01	0.9472E 03	0.1231E 04	0.1231E 04	0.1702E 04	0.2592E 05
12.00	0.3950E 01	0.1889E 01	0.1032E 04	0.1340E 04	0.1340E 04	0.1853E 04	0.2822E 05
12.50	0.4147E 01	0.1889E 01	0.1120E 04	0.1453E 04	0.1453E 04	0.2010E 04	0.3062E 05
13.00	0.4344E 01	0.1889E 01	0.1212E 04	0.1572E 04	0.1572E 04	0.2174E 04	0.3311E 05
13.50	0.4554E 01	0.1889E 01	0.1307E 04	0.1694E 04	0.1694E 04	0.2344E 04	0.3570E 05
14.00	0.4764E 01	0.1888E 01	0.1407E 04	0.1822E 04	0.1822E 04	0.2521E 04	0.3839E 05
14.50	0.4988E 01	0.1888E 01	0.1509E 04	0.1954E 04	0.1954E 04	0.2703E 04	0.4117E 05
15.00	0.5211E 01	0.1888E 01	0.1616E 04	0.2091E 04	0.2091E 04	0.2893E 04	0.4406E 05
15.50	0.5448E 01	0.1888E 01	0.1725E 04	0.2233E 04	0.2233E 04	0.3089E 04	0.4704E 05
16.00	0.5685E 01	0.1888E 01	0.1839E 04	0.2379E 04	0.2379E 04	0.3291E 04	0.5012E 05
16.50	0.5935E 01	0.1888E 01	0.1956E 04	0.2530E 04	0.2530E 04	0.3499E 04	0.5329E 05
17.00	0.6186E 01	0.1887E 01	0.2077E 04	0.2685E 04	0.2685E 04	0.3714E 04	0.5657E 05
17.50	0.6450E 01	0.1887E 01	0.2201E 04	0.2845E 04	0.2845E 04	0.3936E 04	0.5994E 05
18.00	0.6714E 01	0.1887E 01	0.2329E 04	0.3010E 04	0.3010E 04	0.4164E 04	0.6341E 05
18.50	0.6992E 01	0.1887E 01	0.2461E 04	0.3179E 04	0.3179E 04	0.4398E 04	0.6698E 05
19.00	0.7269E 01	0.1887E 01	0.2596E 04	0.3353E 04	0.3353E 04	0.4639E 04	0.7064E 05
19.50	0.7561E 01	0.1886E 01	0.2734E 04	0.3532E 04	0.3532E 04	0.4886E 04	0.7441E 05

DESIGN JET MACH NUMBER = 4.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.7561E 01	0.1886E 01	0.2734E 04	0.3532E 04	0.3532E 04	0.4886E 04	0.7441E 05
20.00	0.7853E 01	0.1886E 01	0.2877E 04	0.3715E 04	0.3715E 04	0.5139E 04	0.7827E 05
20.50	0.8159E 01	0.1886E 01	0.3023E 04	0.3903E 04	0.3903E 04	0.5399E 04	0.8223E 05
21.00	0.8465E 01	0.1886E 01	0.3172E 04	0.4095E 04	0.4095E 04	0.5665E 04	0.8628E 05
21.50	0.8784E 01	0.1886E 01	0.3325E 04	0.4293E 04	0.4293E 04	0.5938E 04	0.9044E 05
22.00	0.9104E 01	0.1886E 01	0.3482E 04	0.4494E 04	0.4494E 04	0.6217E 04	0.9469E 05
22.50	0.9438E 01	0.1885E 01	0.3642E 04	0.4701E 04	0.4701E 04	0.6503E 04	0.9904E 05
23.00	0.9772E 01	0.1885E 01	0.3806E 04	0.4912E 04	0.4912E 04	0.6795E 04	0.1035E 06
23.50	0.1012E 02	0.1885E 01	0.3974E 04	0.5128E 04	0.5128E 04	0.7094E 04	0.1080E 06
24.00	0.1047E 02	0.1885E 01	0.4145E 04	0.5348E 04	0.5348E 04	0.7398E 04	0.1127E 06
24.50	0.1083E 02	0.1885E 01	0.4320E 04	0.5573E 04	0.5573E 04	0.7710E 04	0.1174E 06
25.00	0.1119E 02	0.1884E 01	0.4498E 04	0.5803E 04	0.5803E 04	0.8027E 04	0.1223E 06
25.50	0.1157E 02	0.1884E 01	0.4680E 04	0.6037E 04	0.6037E 04	0.8351E 04	0.1272E 06
26.00	0.1195E 02	0.1884E 01	0.4866E 04	0.6276E 04	0.6276E 04	0.8682E 04	0.1322E 06
26.50	0.1234E 02	0.1884E 01	0.5055E 04	0.6520E 04	0.6520E 04	0.9019E 04	0.1374E 06
27.00	0.1273E 02	0.1884E 01	0.5248E 04	0.6768E 04	0.6768E 04	0.9362E 04	0.1426E 06
27.50	0.1313E 02	0.1884E 01	0.5444E 04	0.7021E 04	0.7021E 04	0.9712E 04	0.1479E 06
28.00	0.1354E 02	0.1883E 01	0.5644E 04	0.7278E 04	0.7278E 04	0.1007E 05	0.1533E 06
28.50	0.1396E 02	0.1883E 01	0.5848E 04	0.7540E 04	0.7540E 04	0.1043E 05	0.1589E 06
29.00	0.1438E 02	0.1883E 01	0.6055E 04	0.7807E 04	0.7807E 04	0.1080E 05	0.1645E 06
29.50	0.1481E 02	0.1883E 01	0.6266E 04	0.8079E 04	0.8079E 04	0.1118E 05	0.1702E 06
30.00	0.1525E 02	0.1883E 01	0.6480E 04	0.8355E 04	0.8355E 04	0.115[illegible]E 05	0.1760E 06
30.50	0.1569E 02	0.1882E 01	0.6698E 04	[illegible] 04	0.8635E 04	0.1195E 05	0.1819E 06
31.00	0.1614E 02	0.1882E 01	0.6920E 04	0.8921E 04	0.8921E 04	0.1234E 05	0.1879E 06
31.50	[illegible] 02	0.1882E 01	0.7145E 04	0.9211E 04	0.9211E 04	0.1274E 05	0.1941E 06
32.00	0.1707E 02	0.1882E 01	0.7374E 04	0.9505E 04	0.9505E 04	0.1315E 05	0.2003E 06
32.50	0.1755E 02	0.1882E 01	0.7606E 04	0.9805E 04	0.9805E 04	0.1356E 05	0.2066E 06
33.00	0.1802E 02	0.1882E 01	0.7842E 04	0.1011E 05	0.1011E 05	0.1398E 05	0.2130E 06
33.50	0.1851E 02	0.1881E 01	0.8082E 04	0.1042E 05	0.1042E 05	0.1441E 05	0.2195E 06
34.00	0.1901E 02	0.1881E 01	0.8325E 04	0.1073E 05	0.1073E 05	0.1484E 05	0.2261E 06

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 5.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.	0.	0.1013E 01	0.1915E 01	0.3103E 02	0.4186E 02	0.1013E 04
1.04	0.	0.	0.1051E 01	0.1984E 01	0.3215E 02	0.4337E 02	0.1050E 04
1.07	0.	0.	0.1089E 01	0.2057E 01	0.3333E 02	0.4496E 02	0.1088E 04
1.10	0.	0.	0.1128E 01	0.2133E 01	0.3456E 02	0.4662E 02	0.1128E 04
1.20	0.1141E 01	0.	0.2073E 02	0.3901E 02	0.3901E 02	0.5262E 02	0.1274E 04
1.30	0.1124E 01	0.	0.2359E 02	0.4397E 02	0.4397E 02	0.5931E 02	0.1436E 04
1.40	0.1119E 01	0.	0.2688E 02	0.4941E 02	0.4941E 02	0.6665E 02	0.1613E 04
1.50	0.1119E 01	0.3025E 02	0.3062E 02	0.5531E 02	0.5531E 02	0.7460E 02	0.1806E 04
1.60	0.1121E 01	0.3071E 02	0.3479E 02	0.6165E 02	0.6165E 02	0.8317E 02	0.2013E 04
1.70	0.1124E 01	0.3074E 02	0.3939E 02	0.6844E 02	0.6844E 02	0.9232E 02	0.2235E 04
1.80	0.1127E 01	0.3076E 02	0.4441E 02	0.7566E 02	0.7566E 02	0.1021E 03	0.2471E 04
1.90	0.1132E 01	0.3079E 02	0.4985E 02	0.8331E 02	0.8331E 02	0.1124E 03	0.2720E 04
2.00	0.1136E 01	0.3082E 02	0.5568E 02	0.9139E 02	0.9139E 02	0.1233E 03	0.2984E 04
2.20	0.1146E 01	0.3082E 02	0.6851E 02	0.1088E 03	0.1088E 03	0.1468E 03	0.3554E 04
2.40	0.1157E 01	0.3080E 02	0.8281E 02	0.1280E 03	0.1280E 03	0.1726E 03	0.4178E 04
2.60	0.1168E 01	0.3078E 02	0.9855E 02	0.1488E 03	0.1488E 03	0.2007E 03	0.4858E 04
2.80	0.1281E 01	0.3076E 02	0.1157E 03	0.1713E 03	0.1713E 03	0.2310E 03	0.5592E 04
3.00	0.1294E 01	0.3075E 02	0.1342E 03	0.1954E 03	0.1954E 03	0.2636E 03	0.6381E 04
3.20	0.1308E 01	0.3073E 02	0.1540E 03	0.2213E 03	0.2213E 03	0.2985E 03	0.7225E 04
3.40	0.1322E 01	0.3071E 02	0.1752E 03	0.2488E 03	0.2488E 03	0.3356E 03	0.8124E 04
3.60	0.1322E 01	0.3069E 02	0.1978E 03	0.2780E 03	0.2780E 03	0.3750E 03	0.9077E 04
3.80	0.1358E 01	0.3067E 02	0.2216E 03	0.3088E 03	0.3088E 03	0.4166E 03	0.1008E 05
4.00	0.1393E 01	0.3066E 02	0.2468E 03	0.3414E 03	0.3414E 03	0.4605E 03	0.1115E 05
4.20	0.1431E 01	0.3066E 02	0.2732E 03	0.3756E 03	0.3756E 03	0.5066E 03	0.1226E 05
4.40	0.1180E 01	0.3065E 02	0.3010E 03	0.4114E 03	0.4114E 03	0.5550E 03	0.1344E 05
4.60	0.1191E 01	0.3065E 02	0.3301E 03	0.4490E 03	0.4490E 03	0.6057E 03	0.1466E 05
4.80	0.1204E 01	0.3065E 02	0.3605E 03	0.4882E 03	0.4882E 03	0.6586E 03	0.1594E 05
5.00	0.1216E 01	0.3065E 02	0.3922E 03	0.5291E 03	0.5291E 03	0.7137E 03	0.1728E 05

DESIGN JET MACH NUMBER = 5.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1229E 01	0.3065E 02	0.3922E 03	0.5291E 03	0.5291E 03	0.7137E 03	0.1728E 05
5.50	0.1241E 01	0.3065E 02	0.4772E 03	0.6386E 03	0.6386E 03	0.8614E 03	0.2085E 05
6.00	0.1254E 01	0.3064E 02	0.5703E 03	0.7586E 03	0.7586E 03	0.1023E 04	0.2477E 05
6.50	0.1268E 01	0.3064E 02	0.6715E 03	0.8889E 03	0.8889E 03	0.1199E 04	0.2903E 05
7.00	0.1468E 01	0.3064E 02	0.7808E 03	0.1030E 04	0.1030E 04	0.1389E 04	0.3363E 05
7.50	0.1507E 01	0.3064E 02	0.8982E 03	0.1181E 04	0.1181E 04	0.1593E 04	0.3856E 05
8.00	0.1546E 01	0.3063E 02	0.1024E 04	0.1343E 04	0.1343E 04	0.1811E 04	0.4384E 05
8.50	0.1587E 01	0.3063E 02	0.1157E 04	0.1515E 04	0.1515E 04	0.2043E 04	0.4946E 05
9.00	0.1628E 01	0.3063E 02	0.1299E 04	0.1697E 04	0.1697E 04	0.2290E 04	0.5542E 05
9.50	0.1671E 01	0.3062E 02	0.1449E 04	0.1890E 04	0.1890E 04	0.2550E 04	0.6173E 05
10.00	0.1714E 01	0.3062E 02	0.1607E 04	0.2094E 04	0.2094E 04	0.2824E 04	0.6837E 05
10.50	0.1758E 01	0.3062E 02	0.1773E 04	0.2308E 04	0.2308E 04	0.3113E 04	0.7535E 05
11.00	0.1803E 01	0.3062E 02	0.1947E 04	0.2532E 04	0.2532E 04	0.3415E 04	0.8267E 05
11.50	0.1849E 01	0.3061E 02	0.2129E 04	0.2767E 04	0.2767E 04	0.3732E 04	0.9034E 05
12.00	0.1896E 01	0.1889E 01	0.2320E 04	0.3012E 04	0.3012E 04	0.4063E 04	0.9834E 05
12.50	0.1944E 01	0.1889E 01	0.2518E 04	0.3267E 04	0.3267E 04	0.4407E 04	0.1067E 06
13.00	0.1992E 01	0.1889E 01	0.2725E 04	0.3533E 04	0.3533E 04	0.4766E 04	0.1154E 06
13.50	0.2043E 01	0.1889E 01	0.2940E 04	0.3810E 04	0.3810E 04	0.5139E 04	0.1244E 06
14.00	0.2093E 01	0.1888E 01	0.3162E 04	0.4097E 04	0.4097E 04	0.5526E 04	0.1338E 06
14.50	0.2145E 01	0.1888E 01	0.3393E 04	0.4394E 04	0.4394E 04	0.5927E 04	0.1435E 06
15.00	0.2197E 01	0.1888E 01	0.3632E 04	0.4702E 04	0.4702E 04	0.6342E 04	0.1535E 06
15.50	0.2252E 01	0.1888E 01	0.3879E 04	0.5020E 04	0.5020E 04	0.6771E 04	0.1639E 06
16.00	0.2306E 01	0.1888E 01	0.4135E 04	0.5348E 04	0.5348E 04	0.7215E 04	0.1746E 06
16.50	0.2362E 01	0.1888E 01	0.4398E 04	0.5687E 04	0.5687E 04	0.7672E 04	0.1857E 06
17.00	0.2419E 01	0.1887E 01	0.4669E 04	0.6037E 04	0.6037E 04	0.8143E 04	0.1971E 06
17.50	0.2477E 01	0.1887E 01	0.4949E 04	0.6397E 04	0.6397E 04	0.8629E 04	0.2089E 06
18.00	0.2535E 01	0.1887E 01	0.5236E 04	0.6767E 04	0.6767E 04	0.9128E 04	0.2210E 06
18.50	0.2596E 01	0.1887E 01	0.5532E 04	0.7148E 04	0.7148E 04	0.9642E 04	0.2334E 06
19.00	0.2656E 01	0.1887E 01	0.5836E 04	0.7539E 04	0.7539E 04	0.1017E 05	0.2462E 06
19.50	0.2719E 01	0.1886E 01	0.6148E 04	0.7940E 04	0.7940E 04	0.1071E 05	0.2593E 06

DESIGN JET MACH NUMBER = 5.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.2719E 01	0.1886E 01	0.6148E 04	0.7940E 04	0.7940E 04	0.1071E 05	0.2593E 06
20.00	0.2782E 01	0.1886E 01	0.6468E 04	0.8352E 04	0.8352E 04	0.1127E 05	0.2727E 06
20.50	0.2847E 01	0.1886E 01	0.6796E 04	0.8775E 04	0.8775E 04	0.1184E 05	0.2865E 06
21.00	0.2911E 01	0.1886E 01	0.7132E 04	0.9208E 04	0.9208E 04	0.1242E 05	0.3007E 06
21.50	0.2978E 01	0.1886E 01	0.7476E 04	0.9651E 04	0.9651E 04	0.1302E 05	0.3151E 06
22.00	0.3045E 01	0.1886E 01	0.7829E 04	0.1010E 05	0.1010E 05	0.1363E 05	0.3300E 06
22.50	0.3114E 01	0.1885E 01	0.8189E 04	0.1057E 05	0.1057E 05	0.1426E 05	0.3451E 06
23.00	0.3183E 01	0.1885E 01	0.8558E 04	0.1104E 05	0.1104E 05	0.1490E 05	0.3606E 06
23.50	0.3255E 01	0.1885E 01	0.8935E 04	0.1153E 05	0.1153E 05	0.1555E 05	0.3765E 06
24.00	0.3326E 01	0.1885E 01	0.9320E 04	0.1202E 05	0.1202E 05	0.1622E 05	0.3926E 06
24.50	0.3400E 01	0.1885E 01	0.9712E 04	0.1253E 05	0.1253E 05	0.1690E 05	0.4092E 06
25.00	0.3474E 01	0.1884E 01	0.1011E 05	0.1305E 05	0.1305E 05	0.1760E 05	0.4260E 06
25.50	0.3550E 01	0.1884E 01	0.1052E 05	0.1357E 05	0.1357E 05	0.1831E 05	0.4432E 06
26.00	0.3626E 01	0.1884E 01	0.1094E 05	0.1411E 05	0.1411E 05	0.1903E 05	0.4608E 06
26.50	0.3705E 01	0.1884E 01	0.1137E 05	0.1466E 05	0.1466E 05	0.1977E 05	0.4786E 06
27.00	0.3783E 01	0.1884E 01	0.1180E 05	0.1522E 05	0.1522E 05	0.2053E 05	0.4969E 06
27.50	0.3864E 01	0.1884E 01	0.1224E 05	0.1578E 05	0.1578E 05	0.2129E 05	0.5154E 06
28.00	0.3944E 01	0.1883E 01	0.1269E 05	0.1636E 05	0.1636E 05	0.2207E 05	0.5343E 06
28.50	0.4027E 01	0.1883E 01	0.1315E 05	0.1695E 05	0.1695E 05	0.2287E 05	0.5536E 06
29.00	0.4111E 01	0.1883E 01	0.1361E 05	0.1755E 05	0.1755E 05	0.2368E 05	0.5732E 06
29.50	0.4196E 01	0.1883E 01	0.1409E 05	0.1816E 05	0.1816E 05	0.2450E 05	0.5931E 06
30.00	0.4280E 01	0.1883E 01	0.1457E 05	0.1878E 05	0.1878E 05	0.2534E 05	0.6134E 06
30.50	0.4368E 01	0.1882E 01	0.1506E 05	0.1941E 05	0.1941E 05	0.2619E 05	0.6340E 06
31.00	0.4455E 01	0.1882E 01	0.1556E 05	0.2006E 05	0.2006E 05	0.2706E 05	0.6549E 06
31.50	0.4545E 01	0.1882E 01	0.1606E 05	0.2071E 05	0.2071E 05	0.2793E 05	0.6762E 06
32.00	0.4635E 01	0.1882E 01	0.1658E 05	0.2137E 05	0.2137E 05	0.2883E 05	0.6978E 06
32.50	0.4728E 01	0.1882E 01	0.1710E 05	0.2204E 05	0.2204E 05	0.2974E 05	0.7198E 06
33.00	0.4820E 01	0.1882E 01	0.1763E 05	0.2273E 05	0.2273E 05	0.3066E 05	0.7421E 06
33.50	0.4915E 01	0.1881E 01	0.1817E 05	0.2342E 05	0.2342E 05	0.3159E 05	0.7648E 06
34.00	0.5010E 01	0.1881E 01	0.1872E 05	0.2412E 05	0.2412E 05	0.3254E 05	0.7878E 06

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 6.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.	0.	0.1013E 01	0.1915E 01	0.6459E 02	0.8592E 02	0.3024E 04
1.04	0.	0.	0.1051E 01	0.1984E 01	0.6693E 02	0.8902E 02	0.3133E 04
1.07	0.	0.	0.1089E 01	0.2057E 01	0.6937E 02	0.9228E 02	0.3248E 04
1.10	0.1085E 01	0.	0.3804E 02	0.7193E 02	0.7193E 02	0.9568E 02	0.3368E 04
1.20	0.1061E 01	0.	0.4314E 02	0.8119E 02	0.8119E 02	0.1080E 03	0.3801E 04
1.30	0.1055E 01	0.	0.4910E 02	0.9152E 02	0.9152E 02	0.1217E 03	0.4284E 04
1.40	0.1054E 01	0.	0.5596E 02	0.1028E 03	0.1028E 03	0.1368E 03	0.4814E 04
1.50	0.1054E 01	0.6295E 02	0.6372E 02	0.1151E 03	0.1151E 03	0.1531E 03	0.5389E 04
1.60	0.1055E 01	0.6392E 02	0.7241E 02	0.1283E 03	0.1283E 03	0.1707E 03	0.6008E 04
1.70	0.1057E 01	0.6397E 02	0.8198E 02	0.1425E 03	0.1425E 03	0.1895E 03	0.6669E 04
1.80	0.1058E 01	0.6403E 02	0.9244E 02	0.1575E 03	0.1575E 03	0.2095E 03	0.7373E 04
1.90	0.1060E 01	0.6409E 02	0.1038E 03	0.1734E 03	0.1734E 03	0.2307E 03	0.8118E 04
2.00	0.1062E 01	0.6415E 02	0.1159E 03	0.1902E 03	0.1902E 03	0.2530E 03	0.8906E 04
2.20	0.1067E 01	0.6414E 02	0.1426E 03	0.2265E 03	0.2265E 03	0.3013E 03	0.1060E 05
2.40	0.1071E 01	0.6411E 02	0.1724E 03	0.2663E 03	0.2663E 03	0.3543E 03	0.1247E 05
2.60	0.1076E 01	0.6407E 02	0.2051E 03	0.3096E 03	0.3096E 03	0.4119E 03	0.1450E 05
2.80	0.1081E 01	0.6403E 02	0.2408E 03	0.3565E 03	0.3565E 03	0.4742E 03	0.1669E 05
3.00	0.1087E 01	0.6399E 02	0.2793E 03	0.4068E 03	0.4068E 03	0.5411E 03	0.1904E 05
3.20	0.1092E 01	0.6396E 02	0.3206E 03	0.4606E 03	0.4606E 03	0.6126E 03	0.2156E 05
3.40	0.1097E 01	0.6392E 02	0.3648E 03	0.5178E 03	0.5178E 03	0.6888E 03	0.2424E 05
3.60	0.1103E 01	0.6388E 02	0.4116E 03	0.5786E 03	0.5786E 03	0.7696E 03	0.2709E 05
3.80	0.1108E 01	0.6385E 02	0.4613E 03	0.6428E 03	0.6428E 03	0.8551E 03	0.3009E 05
4.00	0.1114E 01	0.6381E 02	0.5136E 03	0.7105E 03	0.7105E 03	0.9452E 03	0.3326E 05
4.20	0.1119E 01	0.6381E 02	0.5687E 03	0.7817E 03	0.7817E 03	0.1040E 04	0.3660E 05
4.40	0.1125E 01	0.6380E 02	0.6266E 03	0.8564E 03	0.8564E 03	0.1139E 04	0.4009E 05
4.60	0.1131E 01	0.6380E 02	0.6871E 03	0.9345E 03	0.9345E 03	0.1243E 04	0.4375E 05
4.80	0.1136E 01	0.6380E 02	0.7504E 03	0.1016E 04	0.1016E 04	0.1352E 04	0.4757E 05
5.00	0.1142E 01	0.6380E 02	0.8164E 03	0.1101E 04	0.1101E 04	0.146[illegible]E 04	0.5156E 05

DESIGN JET MACH NUMBER = 6.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1142E 01	0.6380E 02	0.8164E 03	0.1101E 04	0.1101E 04	0.1465E 04	0.5156E 05
5.50	0.1157E 01	0.6379E 02	0.9932E 03	0.1329E 04	0.1329E 04	0.1768E 04	0.6223E 05
6.00	0.1171E 01	0.6378E 02	0.1187E 04	0.1579E 04	0.1579E 04	0.2100E 04	0.7392E 05
6.50	0.1186E 01	0.6378E 02	0.1398E 04	0.1850E 04	0.1850E 04	0.2461E 04	0.8662E 05
7.00	0.1201E 01	0.6377E 02	0.1625E 04	0.2143E 04	0.2143E 04	0.2851E 04	0.1003E 06
7.50	0.1217E 01	0.6377E 02	0.1870E 04	0.2458E 04	0.2458E 04	0.3270E 04	0.1151E 06
8.00	0.1232E 01	0.6376E 02	0.2131E 04	0.2795E 04	0.2795E 04	0.3718E 04	0.1308E 06
8.50	0.1248E 01	0.6375E 02	0.2409E 04	0.3153E 04	0.3153E 04	0.4194E 04	0.1476E 06
9.00	0.1264E 01	0.6375E 02	0.2704E 04	0.3533E 04	0.3533E 04	0.4699E 04	0.1654E 06
9.50	0.1280E 01	0.6374E 02	0.3016E 04	0.3935E 04	0.3935E 04	0.5234E 04	0.1842E 06
10.00	0.1296E 01	0.6374E 02	0.3345E 04	0.4358E 04	0.4358E 04	0.5797E 04	0.2040E 06
10.50	0.1312E 01	0.6373E 02	0.3690E 04	0.4803E 04	0.4803E 04	0.6389E 04	0.2249E 06
11.00	0.1329E 01	0.6372E 02	0.4053E 04	0.5270E 04	0.5270E 04	0.7010E 04	0.2467E 06
11.50	0.1346E 01	0.6372E 02	0.4432E 04	0.5758E 04	0.5758E 04	0.7660E 04	0.2696E 06
12.00	0.1363E 01	0.6371E 02	0.4829E 04	0.6269E 04	0.6269E 04	0.8338E 04	0.2935E 06
12.50	0.1380E 01	0.6371E 02	0.5242E 04	0.6801E 04	0.6801E 04	0.9046E 04	0.3184E 06
13.00	0.1397E 01	0.6370E 02	0.5672E 04	0.7354E 04	0.7354E 04	0.9783E 04	0.3443E 06
13.50	0.1414E 01	0.6369E 02	0.6119E 04	0.7930E 04	0.7930E 04	0.1055E 05	0.3712E 06
14.00	0.1432E 01	0.6369E 02	0.6582E 04	0.8527E 04	0.8527E 04	0.1134E 05	0.3992E 06
14.50	0.1450E 01	0.6368E 02	0.7063E 04	0.9145E 04	0.9145E 04	0.1217E 05	0.4281E 06
15.00	0.1468E 01	0.6368E 02	0.7560E 04	0.9786E 04	0.9786E 04	0.1302E 05	0.4581E 06
15.50	0.1487E 01	0.6367E 02	0.8075E 04	0.1045E 05	0.1045E 05	0.1390E 05	0.4891E 06
16.00	0.1505E 01	0.6366E 02	0.8606E 04	0.1113E 05	0.1113E 05	0.1481E 05	0.5211E 06
16.50	0.1524E 01	0.6366E 02	0.9154E 04	0.1184E 05	0.1184E 05	0.1575E 05	0.5542E 06
17.00	0.1542E 01	0.6365E 02	0.9719E 04	0.1257E 05	0.1257E 05	0.1671E 05	0.5882E 06
17.50	0.1561E 01	0.6365E 02	0.1030E 05	0.1331E 05	0.1331E 05	0.1771E 05	0.6233E 06
18.00	0.1580E 01	0.6364E 02	0.1090E 05	0.1408E 05	0.1408E 05	0.1874E 05	0.6594E 06
18.50	0.1600E 01	0.6363E 02	0.1151E 05	0.1488E 05	0.1488E 05	0.1979E 05	0.6965E 06
19.00	0.1620E 01	0.6363E 02	0.1215E 05	0.1569E 05	0.1569E 05	0.2087E 05	0.7346E 06
19.50	0.1639E 01	0.6362E 02	0.1280E 05	0.1653E 05	0.1653E 05	0.2198E 05	0.7737E 06

DESIGN JET MACH NUMBER = 6.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.1639E 01	0.6362E 02	0.1280E 05	0.1653E 05	0.1653E 05	0.2198E 05	0.7737E 06
20.00	0.1658E 01	0.6361E 02	0.1346E 05	0.1739E 05	0.1739E 05	0.2313E 05	0.8139E 06
20.50	0.1678E 01	0.6361E 02	0.1415E 05	0.1826E 05	0.1826E 05	0.2430E 05	0.8551E 06
21.00	0.1698E 01	0.6360E 02	0.1485E 05	0.1917E 05	0.1917E 05	0.2549E 05	0.8972E 06
21.50	0.1719E 01	0.6360E 02	0.1556E 05	0.2009E 05	0.2009E 05	0.2672E 05	0.9404E 06
22.00	0.1740E 01	0.6359E 02	0.1630E 05	0.2103E 05	0.2103E 05	0.2798E 05	0.9846E 06
22.50	0.1761E 01	0.6358E 02	0.1705E 05	0.2200E 05	0.2200E 05	0.2926E 05	0.1030E 07
23.00	0.1782E 01	0.6358E 02	0.1781E 05	0.2299E 05	0.2299E 05	0.3058E 05	0.1076E 07
23.50	0.1804E 01	0.6357E 02	0.1860E 05	0.2400E 05	0.2400E 05	0.3192E 05	0.1123E 07
24.00	0.1826E 01	0.6357E 02	0.1940E 05	0.2503E 05	0.2503E 05	0.3329E 05	0.1172E 07
24.50	0.1848E 01	0.6356E 02	0.2022E 05	0.2608E 05	0.2608E 05	0.3469E 05	0.1221E 07
25.00	0.1870E 01	0.6355E 02	0.2105E 05	0.2716E 05	0.2716E 05	0.3612E 05	0.1271E 07
25.50	0.1892E 01	0.1884E 01	0.2190E 05	0.2825E 05	0.2825E 05	0.3758E 05	0.1323E 07
26.00	0.1913E 01	0.1884E 01	0.2277E 05	0.2937E 05	0.2937E 05	0.3907E 05	0.1375E 07
26.50	0.1936E 01	0.1884E 01	0.2366E 05	0.3051E 05	0.3051E 05	0.4058E 05	0.1428E 07
27.00	0.1959E 01	0.1884E 01	0.2456E 05	0.3167E 05	0.3167E 05	0.4213E 05	0.1483E 07
27.50	0.1983E 01	0.1884E 01	0.2548E 05	0.3285E 05	0.3285E 05	0.4370E 05	0.1538E 07
28.00	0.2006E 01	0.1883E 01	0.2641E 05	0.3406E 05	0.3406E 05	0.4531E 05	0.1595E 07
28.50	0.2028E 01	0.1883E 01	0.2737E 05	0.3529E 05	0.3529E 05	0.4694E 05	0.1652E 07
29.00	0.2050E 01	0.1883E 01	0.2834E 05	0.3654E 05	0.3654E 05	0.4860E 05	0.1710E 07
29.50	0.2074E 01	0.1883E 01	0.2932E 05	0.3781E 05	0.3781E 05	0.5029E 05	0.1770E 07
30.00	0.2098E 01	0.1883E 01	0.3033E 05	0.3910E 05	0.3910E 05	0.5201E 05	0.1830E 07
30.50	0.2122E 01	0.1882E 01	0.3135E 05	0.4041E 05	0.4041E 05	0.5375E 05	0.1892E 07
31.00	0.2146E 01	0.1882E 01	0.3238E 05	0.4175E 05	0.4175E 05	0.5553E 05	0.1954E 07
31.50	0.2170E 01	0.1882E 01	0.3344E 05	0.4310E 05	0.4310E 05	0.5734E 05	0.2018E 07
32.00	0.2194E 01	0.1882E 01	0.3451E 05	0.4448E 05	0.4448E 05	0.5917E 05	0.2082E 07
32.50	0.2220E 01	0.1882E 01	0.3559E 05	0.4588E 05	0.4588E 05	0.6103E 05	0.2148E 07
33.00	0.2245E 01	0.1882E 01	0.3670E 05	0.4730E 05	0.4730E 05	0.6292E 05	0.2215E 07
33.50	0.2274E 01	0.1881E 01	0.3782E 05	0.4875E 05	0.4875E 05	0.6484E 05	0.2282E 07
34.00	0.2302E 01	0.1881E 01	0.3896E 05	0.5021E 05	0.5021E 05	0.6679E 05	0.2351E 07

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 7.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.	0.	0.1013E 01	0.1915E 01	0.1248E 03	0.1645E 03	0.7929E 04
1.04	0.	0.	0.1051E 01	0.1984E 01	0.1293E 03	0.1705E 03	0.8215E 04
1.07	0.1047E 01	0.	0.7096E 02	0.1340E 03	0.1340E 03	0.1767E 03	0.8516E 04
1.10	0.1038E 01	0.	0.7347E 02	0.1389E 03	0.1389E 03	0.1832E 03	0.8830E 04
1.20	0.1030E 01	0.	0.8332E 02	0.1568E 03	0.1568E 03	0.2068E 03	0.9967E 04
1.30	0.1028E 01	0.	0.9484E 02	0.1768E 03	0.1768E 03	0.2331E 03	0.1123E 05
1.40	0.1027E 01	0.	0.1081E 03	0.1986E 03	0.1986E 03	0.2620E 03	0.1262E 05
1.50	0.1027E 01	0.1216E 03	0.1231E 03	0.2223E 03	0.2223E 03	0.2932E 03	0.1413E 05
1.60	0.1028E 01	0.1235E 03	0.1398E 03	0.2479E 03	0.2479E 03	0.3269E 03	0.1575E 05
1.70	0.1029E 01	0.1236E 03	0.1583E 03	0.2751E 03	0.2751E 03	0.3629E 03	0.1749E 05
1.80	0.1029E 01	0.1237E 03	0.1785E 03	0.3042E 03	0.3042E 03	0.4012E 03	0.1933E 05
1.90	0.1030E 01	0.1238E 03	0.2004E 03	0.3349E 03	0.3349E 03	0.4417E 03	0.2129E 05
2.00	0.1031E 01	0.1239E 03	0.2239E 03	0.3674E 03	0.3674E 03	0.4846E 03	0.2335E 05
2.20	0.1034E 01	0.1239E 03	0.2754E 03	0.4375E 03	0.4375E 03	0.5770E 03	0.2781E 05
2.40	0.1036E 01	0.1238E 03	0.3329E 03	0.5144E 03	0.5144E 03	0.6784E 03	0.3269E 05
2.60	0.1038E 01	0.1237E 03	0.3962E 03	0.5981E 03	0.5981E 03	0.7888E 03	0.3801E 05
2.80	0.1041E 01	0.1237E 03	0.4651E 03	0.6885E 03	0.6885E 03	0.9080E 03	0.4376E 05
3.00	0.1044E 01	0.1236E 03	0.5395E 03	0.7857E 03	0.7857E 03	0.1036E 04	0.4993E 05
3.20	0.1046E 01	0.1235E 03	0.6193E 03	0.8896E 03	0.8896E 03	0.1173E 04	0.5653E 05
3.40	0.1049E 01	0.1235E 03	0.7045E 03	0.1000E 04	0.1000E 04	0.1319E 04	0.6356E 05
3.60	0.1051E 01	0.1234E 03	0.7951E 03	0.1118E 04	0.1118E 04	0.1474E 04	0.7102E 05
3.80	0.1054E 01	0.1233E 03	0.8909E 03	0.1242E 04	0.1242E 04	0.1638E 04	0.7891E 05
4.00	0.1057E 01	0.1232E 03	0.9921E 03	0.1372E 04	0.1372E 04	0.1810E 04	0.8722E 05
4.20	0.1060E 01	0.1232E 03	0.1099E 04	0.1510E 04	0.1510E 04	0.1991E 04	0.9596E 05
4.40	0.1062E 01	0.1232E 03	0.1210E 04	0.1654E 04	0.1654E 04	0.2182E 04	0.1051E 06
4.60	0.1065E 01	0.1232E 03	0.1327E 04	0.1805E 04	0.1805E 04	0.2381E 04	0.1147E 06
4.80	0.1068E 01	0.1232E 03	0.1449E 04	0.1963E 04	0.1963E 04	0.2589E 04	0.1247E 06
5.00	0.1071E 01	0.1232E 03	0.1577E 04	0.2127E 04	0.2127E 04	0.2805E 04	0.1352E 06

DESIGN JET MACH NUMBER = 7.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1071E 01	0.1232E 03	0.1577E 04	0.2127E 04	0.2127E 04	0.2805E 04	0.1352E 06
5.50	0.1078E 01	0.1232E 03	0.1918E 04	0.2567E 04	0.2567E 04	0.3386E 04	0.1632E 06
6.00	0.1085E 01	0.1232E 03	0.2293E 04	0.3050E 04	0.3050E 04	0.4022E 04	0.1938E 06
6.50	0.1092E 01	0.1232E 03	0.2699E 04	0.3574E 04	0.3574E 04	0.4713E 04	0.2271E 06
7.00	0.1099E 01	0.1232E 03	0.3139E 04	0.4140E 04	0.4140E 04	0.5460E 04	0.2631E 06
7.50	0.1106E 01	0.1232E 03	0.3611E 04	0.4748E 04	0.4748E 04	0.6262E 04	0.3017E 06
8.00	0.1113E 01	0.1232E 03	0.4116E 04	0.5398E 04	0.5398E 04	0.7119E 04	0.3430E 06
8.50	0.1121E 01	0.1231E 03	0.4653E 04	0.6090E 04	0.6090E 04	0.8032E 04	0.3870E 06
9.00	0.1128E 01	0.1231E 03	0.5223E 04	0.6824E 04	0.6824E 04	0.9000E 04	0.4337E 06
9.50	0.1136E 01	0.1231E 03	0.5825E 04	0.7599E 04	0.7599E 04	0.1002E 05	0.4830E 06
10.00	0.1143E 01	0.1231E 03	0.6460E 04	0.8417E 04	0.8417E 04	0.1110E 05	0.5349E 06
10.50	0.1151E 01	0.1231E 03	0.7128E 04	0.9277E 04	0.9277E 04	0.1224E 05	0.5896E 06
11.00	0.1158E 01	0.1231E 03	0.7828E 04	0.1018E 05	0.1018E 05	0.1342E 05	0.6469E 06
11.50	0.1166E 01	0.1231E 03	0.8561E 04	0.1112E 05	0.1112E 05	0.1467E 05	0.7068E 06
12.00	0.1173E 01	0.1231E 03	0.9326E 04	0.1211E 05	0.1211E 05	0.1597E 05	0.7695E 06
12.50	0.1181E 01	0.1230E 03	0.1012E 05	0.1313E 05	0.1313E 05	0.1732E 05	0.8348E 06
13.00	0.1189E 01	0.1230E 03	0.1095E 05	0.1420E 05	0.1420E 05	0.1873E 05	0.9027E 06
13.50	0.1196E 01	0.1230E 03	0.1182E 05	0.1532E 05	0.1532E 05	0.2020E 05	0.9734E 06
14.00	0.1204E 01	0.1230E 03	0.1271E 05	0.1647E 05	0.1647E 05	0.2172E 05	0.1047E 07
14.50	0.1212E 01	0.1230E 03	0.1364E 05	0.1766E 05	0.1766E 05	0.2330E 05	0.1123E 07
15.00	0.1220E 01	0.1230E 03	0.1460E 05	0.1890E 05	0.1890E 05	0.2493E 05	0.1201E 07
15.50	0.1228E 01	0.1230E 03	0.1560E 05	0.2018E 05	0.2018E 05	0.2662E 05	0.1283E 07
16.00	0.1236E 01	0.1230E 03	0.1662E 05	0.2150E 05	0.2150E 05	0.2836E 05	0.1366E 07
16.50	0.1244E 01	0.1230E 03	0.1768E 05	0.2286E 05	0.2286E 05	0.3016E 05	0.1453E 07
17.00	0.1252E 01	0.1229E 03	0.1877E 05	0.2427E 05	0.2427E 05	0.3201E 05	0.1542E 07
17.50	0.1260E 01	0.1229E 03	0.1990E 05	0.2572E 05	0.2572E 05	0.3392E 05	0.1634E 07
18.00	0.1267E 01	0.1229E 03	0.2105E 05	0.2720E 05	0.2720E 05	0.3588E 05	0.1729E 07
18.50	0.1275E 01	0.1229E 03	0.2224E 05	0.2874E 05	0.2874E 05	0.3790E 05	0.1826E 07
19.00	0.1283E 01	0.1229E 03	0.2346E 05	0.3031E 05	0.3031E 05	0.3997E 05	0.1926E 07
19.50	0.1292E 01	0.1229E 03	0.2472E 05	0.3192E 05	0.3192E 05	0.4210E 05	0.2029E 07

DESIGN JET MACH NUMBER = 7.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.1292E 01	0.1229E 03	0.2472E 05	0.3192E 05	0.3192E 05	0.4210E 05	0.2029E 07
20.00	0.1301E 01	0.1229E 03	0.2600E 05	0.3358E 05	0.3358E 05	0.4429E 05	0.2134E 07
20.50	0.1309E 01	0.1229E 03	0.2732E 05	0.3528E 05	0.3528E 05	0.4653E 05	0.2242E 07
21.00	0.1317E 01	0.1228E 03	0.2867E 05	0.3702E 05	0.3702E 05	0.4882E 05	0.2353E 07
21.50	0.1325E 01	0.1228E 03	0.3006E 05	0.3880E 05	0.3880E 05	0.5117E 05	0.2466E 07
22.00	0.1333E 01	0.1228E 03	0.3147E 05	0.4062E 05	0.4062E 05	0.5358E 05	0.2582E 07
22.50	0.1342E 01	0.1228E 03	0.3292E 05	0.4249E 05	0.4249E 05	0.5604E 05	0.2700E 07
23.00	0.1351E 01	0.1228E 03	0.3441E 05	0.4440E 05	0.4440E 05	0.5856E 05	0.2822E 07
23.50	0.1358E 01	0.1228E 03	0.3592E 05	0.4635E 05	0.4635E 05	0.6113E 05	0.2946E 07
24.00	0.1366E 01	0.1228E 03	0.3747E 05	0.4834E 05	0.4834E 05	0.6376E 05	0.3072E 07
24.50	0.1377E 01	0.1228E 03	0.3905E 05	0.5037E 05	0.5037E 05	0.6644E 05	0.3201E 07
25.00	0.1388E 01	0.1228E 03	0.4066E 05	0.5245E 05	0.5245E 05	0.6918E 05	0.3333E 07
25.50	0.1395E 01	0.1227E 03	0.4230E 05	0.5457E 05	0.5457E 05	0.7197E 05	0.3468E 07
26.00	0.1403E 01	0.1227E 03	0.4398E 05	0.5673E 05	0.5673E 05	0.7482E 05	0.3605E 07
26.50	0.1413E 01	0.1227E 03	0.4569E 05	0.5893E 05	0.5893E 05	0.7772E 05	0.3745E 07
27.00	0.1423E 01	0.1227E 03	0.4743E 05	0.6117E 05	0.6117E 05	0.8068E 05	0.3888E 07
27.50	0.1430E 01	0.1227E 03	0.4921E 05	0.6346E 05	0.6346E 05	0.8369E 05	0.4033E 07
28.00	0.1438E 01	0.1227E 03	0.5102E 05	0.6579E 05	0.6579E 05	0.8676E 05	0.4181E 07
28.50	0.1445E 01	0.1227E 03	0.5286E 05	0.6815E 05	0.6815E 05	0.8989E 05	0.4331E 07
29.00	0.1452E 01	0.1227E 03	0.5473E 05	0.7057E 05	0.7057E 05	0.9307E 05	0.4485E 07
29.50	0.1466E 01	0.1226E 03	0.5663E 05	0.7302E 05	0.7302E 05	0.9630E 05	0.4641E 07
30.00	0.1479E 01	0.1226E 03	0.5857E 05	0.7551E 05	0.7551E 05	0.9959E 05	0.4799E 07
30.50	0.1487E 01	0.1226E 03	0.6054E 05	0.7805E 05	0.7805E 05	0.1029E 06	0.4960E 07
31.00	0.1495E 01	0.1226E 03	0.6255E 05	0.8063E 05	0.8063E 05	0.1063E 06	0.5124E 07
31.50	0.1502E 01	0.1226E 03	0.6458E 05	0.8325E 05	0.8325E 05	0.1098E 06	0.5291E 07
32.00	0.1510E 01	0.1226E 03	0.6665E 05	0.8591E 05	0.8591E 05	0.1133E 06	0.5460E 07
32.50	0.1520E 01	0.1226E 03	0.6875E 05	0.8862E 05	0.8862E 05	0.1169E 06	0.5632E 07
33.00	0.1530E 01	0.1226E 03	0.7088E 05	0.9137E 05	0.9137E 05	0.1205E 06	0.5807E 07
33.50	0.1539E 01	0.1226E 03	0.7305E 05	0.9416E 05	0.9416E 05	0.1242E 06	0.5984E 07
34.00	0.1548E 01	0.1225E 03	0.7525E 05	0.9699E 05	0.9699E 05	0.1279E 06	0.6164E 07

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 8.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.	0.	0.1013E 01	0.1915E 01	0.2256E 03	0.2959E 03	0.1870E 05
1.04	0.1027E 01	0.	0.1238E 03	0.2338E 03	0.2338E 03	0.3066E 03	0.1937E 05
1.07	0.1024E 01	0.	0.1283E 03	0.2423E 03	0.2423E 03	0.3178E 03	0.2008E 05
1.10	0.1020E 01	0.	0.1329E 03	0.2513E 03	0.2513E 03	0.3296E 03	0.2082E 05
1.20	0.1016E 01	0.	0.1507E 03	0.2836E 03	0.2836E 03	0.3720E 03	0.2350E 05
1.30	0.1015E 01	0.	0.1715E 03	0.3197E 03	0.3197E 03	0.4193E 03	0.2649E 05
1.40	0.1015E 01	0.	0.1955E 03	0.3592E 03	0.3592E 03	0.4712E 03	0.2977E 05
1.50	0.1015E 01	0.2199E 03	0.2226E 03	0.4021E 03	0.4021E 03	0.5274E 03	0.3332E 05
1.60	0.1015E 01	0.2233E 03	0.2529E 03	0.4483E 03	0.4483E 03	0.5879E 03	0.3715E 05
1.70	0.1016E 01	0.2235E 03	0.2864E 03	0.4976E 03	0.4976E 03	0.6527E 03	0.4124E 05
1.80	0.1016E 01	0.2237E 03	0.3229E 03	0.5501E 03	0.5501E 03	0.7215E 03	0.4559E 05
1.90	0.1017E 01	0.2239E 03	0.3624E 03	0.6058E 03	0.6058E 03	0.7945E 03	0.5020E 05
2.00	0.1017E 01	0.2241E 03	0.4049E 03	0.6645E 03	0.6645E 03	0.8716E 03	0.5507E 05
2.20	0.1018E 01	0.2241E 03	0.4981E 03	0.7913E 03	0.7913E 03	0.1038E 04	0.6557E 05
2.40	0.1020E 01	0.2239E 03	0.6021E 03	0.9304E 03	0.9304E 03	0.1220E 04	0.7710E 05
2.60	0.1021E 01	0.2238E 03	0.7166E 03	0.1082E 04	0.1082E 04	0.1419E 04	0.8964E 05
2.80	0.1022E 01	0.2237E 03	0.8412E 03	0.1245E 04	0.1245E 04	0.1633E 04	0.1032E 06
3.00	0.1024E 01	0.2236E 03	0.9757E 03	0.1421E 04	0.1421E 04	0.1864E 04	0.1177E 06
3.20	0.1025E 01	0.2234E 03	0.1120E 04	0.1609E 04	0.1609E 04	0.2110E 04	0.1333E 06
3.40	0.1026E 01	0.2233E 03	0.1274E 04	0.1809E 04	0.1809E 04	0.2373E 04	0.1499E 06
3.60	0.1028E 01	0.2232E 03	0.1438E 04	0.2021E 04	0.2021E 04	0.2651E 04	0.1675E 06
3.80	0.1029E 01	0.2230E 03	0.1611E 04	0.2246E 04	0.2246E 04	0.2945E 04	0.1861E 06
4.00	0.1031E 01	0.2229E 03	0.1794E 04	0.2482E 04	0.2482E 04	0.3255E 04	0.2057E 06
4.20	0.1032E 01	0.2229E 03	0.1987E 04	0.2731E 04	0.2731E 04	0.3582E 04	0.2263E 06
4.40	0.1034E 01	0.2229E 03	0.2189E 04	0.2992E 04	0.2992E 04	0.3924E 04	0.2479E 06
4.60	0.1035E 01	0.2229E 03	0.2400E 04	0.3265E 04	0.3265E 04	0.4282E 04	0.2705E 06
4.80	0.1037E 01	0.2229E 03	0.2621E 04	0.3550E 04	0.3550E 04	0.4656E 04	0.2942E 06
5.00	0.1038E 01	0.2229E 03	0.2852E 04	0.3847E 04	0.3847E 04	0.5046E 04	0.3188E 06

DESIGN JET MACH NUMBER = 8.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1038E 01	0.2229E 03	0.2852E 04	0.3847E 04	0.3847E 04	0.5046E 04	0.3188E 06
5.50	0.1042E 01	0.2228E 03	0.3470E 04	0.4643E 04	0.4643E 04	0.6090E 04	0.3848E 06
6.00	0.1046E 01	0.2228E 03	0.4146E 04	0.5516E 04	0.5516E 04	0.7234E 04	0.4570E 06
6.50	0.1049E 01	0.2228E 03	0.4882E 04	0.6464E 04	0.6464E 04	0.8477E 04	0.5356E 06
7.00	0.1053E 01	0.2228E 03	0.5677E 04	0.7487E 04	0.7487E 04	0.9820E 04	0.6205E 06
7.50	0.1057E 01	0.2228E 03	0.6531E 04	0.8587E 04	0.8587E 04	0.1126E 05	0.7116E 06
8.00	0.1061E 01	0.2227E 03	0.7444E 04	0.9763E 04	0.9763E 04	0.1280E 05	0.8090E 06
8.50	0.1064E 01	0.2227E 03	0.8416E 04	0.1101E 05	0.1101E 05	0.1445E 05	0.9127E 06
9.00	0.1068E 01	0.2227E 03	0.9446E 04	0.1234E 05	0.1234E 05	0.1619E 05	0.1023E 07
9.50	0.1072E 01	0.2227E 03	0.1054E 05	0.1374E 05	0.1374E 05	0.1803E 05	0.1139E 07
10.00	0.1076E 01	0.2227E 03	0.1168E 05	0.1522E 05	0.1522E 05	0.1997E 05	0.1262E 07
10.50	0.1080E 01	0.2226E 03	0.1289E 05	0.1678E 05	0.1678E 05	0.2201E 05	0.1390E 07
11.00	0.1084E 01	0.2226E 03	0.1416E 05	0.1841E 05	0.1841E 05	0.2414E 05	0.1525E 07
11.50	0.1088E 01	0.2226E 03	0.1548E 05	0.2012E 05	0.2012E 05	0.2638E 05	0.1667E 07
12.00	0.1092E 01	0.2226E 03	0.1687E 05	0.2190E 05	0.2190E 05	0.2872E 05	0.1815E 07
12.50	0.1096E 01	0.2225E 03	0.1831E 05	0.2376E 05	0.2376E 05	0.3116E 05	0.1969E 07
13.00	0.1099E 01	0.2225E 03	0.1981E 05	0.2569E 05	0.2569E 05	0.3369E 05	0.2129E 07
13.50	0.1103E 01	0.2225E 03	0.2137E 05	0.2770E 05	0.2770E 05	0.3633E 05	0.2295E 07
14.00	0.1108E 01	0.2225E 03	0.2299E 05	0.2979E 05	0.2979E 05	0.3907E 05	0.2468E 07
14.50	0.1111E 01	0.2225E 03	0.2467E 05	0.3195E 05	0.3195E 05	0.4190E 05	0.2647E 07
15.00	0.1114E 01	0.2224E 03	0.2641E 05	0.3419E 05	0.3419E 05	0.4484E 05	0.2833E 07
15.50	0.1119E 01	0.2224E 03	0.2821E 05	0.3650E 05	0.3650E 05	0.4787E 05	0.3024E 07
16.00	0.1123E 01	0.2224E 03	0.3006E 05	0.3889E 05	0.3889E 05	0.5100E 05	0.3222E 07
16.50	0.1126E 01	0.2224E 03	0.3198E 05	0.4135E 05	0.4135E 05	0.5424E 05	0.3427E 07
17.00	0.1129E 01	0.2224E 03	0.3395E 05	0.4389E 05	0.4389E 05	0.5757E 05	0.3637E 07
17.50	0.1134E 01	0.2223E 03	0.3598E 05	0.4651E 05	0.4651E 05	0.6100E 05	0.3854E 07
18.00	0.1139E 01	0.2223E 03	0.3807E 05	0.4920E 05	0.4920E 05	0.6453E 05	0.4077E 07
18.50	0.1142E 01	0.2223E 03	0.4022E 05	0.5197E 05	0.5197E 05	0.6816E 05	0.4307E 07
19.00	0.1145E 01	0.2223E 03	0.4243E 05	0.5482E 05	0.5482E 05	0.7189E 05	0.4542E 07
19.50	0.1150E 01	0.2222E 03	0.4470E 05	0.5774E 05	0.5774E 05	0.7572E 05	0.4784E 07

DESIGN JET MACH NUMBER = 8.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.1150E 01	0.2222E 03	0.4470E 05	0.5774E 05	0.5774E 05	0.7572E 05	0.4784E 07
20.00	0.1155E 01	0.2222E 03	0.4703E 05	0.6073E 05	0.6073E 05	0.7965E 05	0.5033E 07
20.50	0.1159E 01	0.2222E 03	0.4941E 05	0.6380E 05	0.6380E 05	0.8368E 05	0.5287E 07
21.00	0.1162E 01	0.2222E 03	0.5186E 05	0.6695E 05	0.6695E 05	0.8781E 05	0.5548E 07
21.50	0.1166E 01	0.2222E 03	0.5436E 05	0.7018E 05	0.7018E 05	0.9204E 05	0.5815E 07
22.00	0.1169E 01	0.2221E 03	0.5692E 05	0.7347E 05	0.7347E 05	0.9636E 05	0.6088E 07
22.50	0.1175E 01	0.2221E 03	0.5955E 05	0.7685E 05	0.7685E 05	0.1008E 06	0.6368E 07
23.00	0.1182E 01	0.2221E 03	0.6223E 05	0.8030E 05	0.8030E 05	0.1053E 06	0.6654E 07
23.50	0.1186E 01	0.2221E 03	0.6497E 05	0.8383E 05	0.8383E 05	0.1099E 06	0.6946E 07
24.00	0.1189E 01	0.2221E 03	0.6776E 05	0.8743E 05	0.8743E 05	0.1147E 06	0.7245E 07
24.50	0.1190E 01	0.2220E 03	0.7062E 05	0.9111E 05	0.9111E 05	0.1195E 06	0.7550E 07
25.00	0.1190E 01	0.2220E 03	0.7354E 05	0.9486E 05	0.9486E 05	0.1244E 06	0.7861E 07
25.50	0.1194E 01	0.2220E 03	0.7651E 05	0.9869E 05	0.9869E 05	0.1294E 06	0.8178E 07
26.00	0.1199E 01	0.2220E 03	0.7955E 05	0.1026E 06	0.1026E 06	0.1346E 06	0.8502E 07
26.50	0.1201E 01	0.2220E 03	0.8264E 05	0.1066E 06	0.1066E 06	0.1398E 06	0.8832E 07
27.00	0.1204E 01	0.2219E 03	0.8579E 05	0.1106E 06	0.1106E 06	0.1451E 06	0.9168E 07
27.50	0.1209E 01	0.2219E 03	0.8900E 05	0.1148E 06	0.1148E 06	0.1505E 06	0.9511E 07
28.00	0.1215E 01	0.2219E 03	0.9227E 05	0.1190E 06	0.1190E 06	0.1561E 06	0.9860E 07
28.50	0.1221E 01	0.2219E 03	0.9560E 05	0.1233E 06	0.1233E 06	0.1617E 06	0.1021E 08
29.00	0.1227E 01	0.2218E 03	0.9898E 05	0.1276E 06	0.1276E 06	0.1674E 06	0.1058E 08
29.50	0.1227E 01	0.2218E 03	0.1024E 06	0.1321E 06	0.1321E 06	0.1732E 06	0.1094E 08
30.00	0.1227E 01	0.2218E 03	0.1059E 06	0.1366E 06	0.1366E 06	0.1791E 06	0.1132E 08
30.50	0.1235E 01	0.2218E 03	0.1095E 06	0.1412E 06	0.1412E 06	0.1851E 06	0.1170E 08
31.00	0.1244E 01	0.2218E 03	0.1131E 06	0.1458E 06	0.1458E 06	0.1913E 06	0.1208E 08
31.50	0.1241E 01	0.2217E 03	0.1168E 06	0.1506E 06	0.1506E 06	0.1975E 06	0.1248E 08
32.00	0.1238E 01	0.2217E 03	0.1205E 06	0.1554E 06	0.1554E 06	0.2038E 06	0.1288E 08
32.50	0.1253E 01	0.2217E 03	0.1243E 06	0.1603E 06	0.1603E 06	0.2102E 06	0.1328E 08
33.00	0.1268E 01	0.2217E 03	0.1282E 06	0.1652E 06	0.1652E 06	0.2167E 06	0.1369E 08
33.50	0.1268E 01	0.2217E 03	0.1321E 06	0.1703E 06	0.1703E 06	0.2233E 06	0.1411E 08
34.00	0.1268E 01	0.2216E 03	0.1361E 06	0.1754E 06	0.1754E 06	0.2301E 06	0.1454E 08

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 9.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.	0.	0.1013E 01	0.1915E 01	0.3858E 03	0.5041E 03	0.4042E 05
1.04	0.1018E 01	0.	0.2118E 03	0.3998E 03	0.3998E 03	0.5223E 03	0.4188E 05
1.07	0.1013E 01	0.	0.2195E 03	0.4144E 03	0.4144E 03	0.5414E 03	0.4341E 05
1.10	0.1012E 01	0.	0.2272E 03	0.4297E 03	0.4297E 03	0.5614E 03	0.4501E 05
1.20	0.1009E 01	0.	0.2577E 03	0.4850E 03	0.4850E 03	0.6337E 03	0.5081E 05
1.30	0.1009E 01	0.	0.2933E 03	0.5467E 03	0.5467E 03	0.7142E 03	0.5727E 05
1.40	0.1009E 01	0.	0.3343E 03	0.6143E 03	0.6143E 03	0.8026E 03	0.6435E 05
1.50	0.1009E 01	0.3760E 03	0.3807E 03	0.6876E 03	0.6876E 03	0.8984E 03	0.7203E 05
1.60	0.1009E 01	0.3818E 03	0.4325E 03	0.7665E 03	0.7665E 03	0.1001E 04	0.8030E 05
1.70	0.1009E 01	0.3821E 03	0.4897E 03	0.8509E 03	0.8509E 03	0.1112E 04	0.8914E 05
1.80	0.1009E 01	0.3825E 03	0.5522E 03	0.9407E 03	0.9407E 03	0.1229E 04	0.9854E 05
1.90	0.1010E 01	0.3828E 03	0.6198E 03	0.1036E 04	0.1036E 04	0.1353E 04	0.1085E 06
2.00	0.1010E 01	0.3832E 03	0.6923E 03	0.1136E 04	0.1136E 04	0.1485E 04	0.1190E 06
2.20	0.1011E 01	0.3832E 03	0.8517E 03	0.1353E 04	0.1353E 04	0.1768E 04	0.1417E 06
2.40	0.1011E 01	0.3829E 03	0.1030E 04	0.1591E 04	0.1591E 04	0.2078E 04	0.1667E 06
2.60	0.1012E 01	0.3827E 03	0.1225E 04	0.1850E 04	0.1850E 04	0.2417E 04	0.1938E 06
2.80	0.1013E 01	0.3825E 03	0.1438E 04	0.2129E 04	0.2129E 04	0.2782E 04	0.2230E 06
3.00	0.1014E 01	0.3823E 03	0.1668E 04	0.2430E 04	0.2430E 04	0.3174E 04	0.2545E 06
3.20	0.1014E 01	0.3820E 03	0.1915E 04	0.2751E 04	0.2751E 04	0.3594E 04	0.2882E 06
3.40	0.1015E 01	0.3818E 03	0.2179E 04	0.3093E 04	0.3093E 04	0.4041E 04	0.3240E 06
3.60	0.1016E 01	0.3816E 03	0.2459E 04	0.3456E 04	0.3456E 04	0.4515E 04	0.3620E 06
3.80	0.1017E 01	0.3814E 03	0.2755E 04	0.3840E 04	0.3840E 04	0.5017E 04	0.4022E 06
4.00	0.1018E 01	0.3812E 03	0.3068E 04	0.4244E 04	0.4244E 04	0.5545E 04	0.4446E 06
4.20	0.1019E 01	0.3811E 03	0.3397E 04	0.4670E 04	0.4670E 04	0.6101E 04	0.4892E 06
4.40	0.1019E 01	0.3811E 03	0.3743E 04	0.5116E 04	0.5116E 04	0.6684E 04	0.5359E 06
4.60	0.1020E 01	0.3811E 03	0.4104E 04	0.5582E 04	0.5582E 04	0.7293E 04	0.5848E 06
4.80	0.1021E 01	0.3811E 03	0.4482E 04	0.6070E 04	0.6070E 04	0.7930E 04	0.6358E 06
5.00	0.1022E 01	0.3811E 03	0.4877E 04	0.6578E 04	0.6578E 04	0.8594E 04	0.6891E 06

DESIGN JET MACH NUMBER = 9.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1022E 01	0.3811E 03	0.4877E 04	0.6578E 04	0.6578E 04	0.8594E 04	0.6891E 06
5.50	0.1024E 01	0.3810E 03	0.5933E 04	0.7940E 04	0.7940E 04	0.1037E 05	0.8317E 06
6.00	0.1026E 01	0.3810E 03	0.7090E 04	0.9431E 04	0.9431E 04	0.1232E 05	0.9880E 06
6.50	0.1028E 01	0.3810E 03	0.8348E 04	0.1105E 05	0.1105E 05	0.1444E 05	0.1158E 07
7.00	0.1031E 01	0.3809E 03	0.9708E 04	0.1280E 05	0.1280E 05	0.1673E 05	0.1341E 07
7.50	0.1033E 01	0.3809E 03	0.1117E 05	0.1468E 05	0.1468E 05	0.1918E 05	0.1538E 07
8.00	0.1035E 01	0.3809E 03	0.1273E 05	0.1669E 05	0.1669E 05	0.2181E 05	0.1749E 07
8.50	0.1037E 01	0.3808E 03	0.1439E 05	0.1883E 05	0.1883E 05	0.2461E 05	0.1973E 07
9.00	0.1039E 01	0.3808E 03	0.1615E 05	0.2110E 05	0.2110E 05	0.2757E 05	0.2211E 07
9.50	0.1041E 01	0.3808E 03	0.1802E 05	0.2350E 05	0.2350E 05	0.3071E 05	0.2462E 07
10.00	0.1044E 01	0.3807E 03	0.1998E 05	0.2603E 05	0.2603E 05	0.3401E 05	0.2727E 07
10.50	0.1046E 01	0.3807E 03	0.2204E 05	0.2869E 05	0.2869E 05	0.3748E 05	0.3005E 07
11.00	0.1048E 01	0.3806E 03	0.2421E 05	0.3148E 05	0.3148E 05	0.4113E 05	0.3297E 07
11.50	0.1050E 01	0.3806E 03	0.2648E 05	0.3440E 05	0.3440E 05	0.4494E 05	0.3603E 07
12.00	0.1051E 01	0.3806E 03	0.2884E 05	0.3744E 05	0.3744E 05	0.4892E 05	0.3922E 07
12.50	0.1054E 01	0.3805E 03	0.3131E 05	0.4062E 05	0.4062E 05	0.5307E 05	0.4255E 07
13.00	0.1056E 01	0.3805E 03	0.3388E 05	0.4393E 05	0.4393E 05	0.5739E 05	0.4602E 07
13.50	0.1059E 01	0.3805E 03	0.3655E 05	0.4737E 05	0.4737E 05	0.6188E 05	0.4962E 07
14.00	0.1061E 01	0.3804E 03	0.3932E 05	0.5093E 05	0.5093E 05	0.6654E 05	0.5335E 07
14.50	0.1063E 01	0.3804E 03	0.4219E 05	0.5463E 05	0.5463E 05	0.7137E 05	0.5723E 07
15.00	0.1064E 01	0.3804E 03	0.4516E 05	0.5845E 05	0.5845E 05	0.7637E 05	0.6123E 07
15.50	0.1066E 01	0.3803E 03	0.4823E 05	0.6241E 05	0.6241E 05	0.8154E 05	0.6538E 07
16.00	0.1067E 01	0.3803E 03	0.5141E 05	0.6650E 05	0.6650E 05	0.8688E 05	0.6966E 07
16.50	0.1069E 01	0.3802E 03	0.5468E 05	0.7071E 05	0.7071E 05	0.9238E 05	0.7407E 07
17.00	0.1071E 01	0.3802E 03	0.5805E 05	0.7506E 05	0.7506E 05	0.9806E 05	0.7862E 07
17.50	0.1073E 01	0.3802E 03	0.6153E 05	0.7953E 05	0.7953E 05	0.1039E 06	0.8331E 07
18.00	0.1075E 01	0.3801E 03	0.6510E 05	0.8413E 05	0.8413E 05	0.1099E 06	0.8813E 07
18.50	0.1078E 01	0.3801E 03	0.6878E 05	0.8887E 05	0.8887E 05	0.1161E 06	0.9309E 07
19.00	0.1080E 01	0.3801E 03	0.7256E 05	0.9373E 05	0.9373E 05	0.1225E 06	0.9819E 07
19.50	0.1083E 01	0.3800E 03	0.7644E 05	0.9872E 05	0.9872E 05	0.1290E 06	0.1034E 08

DESIGN JET MACH NUMBER = 9.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.1083E 01	0.3800E 03	0.7644E 05	0.9872E 05	0.9872E 05	0.1290E 06	0.1034E 08
20.00	0.1085E 01	0.3800E 03	0.8041E 05	0.1038E 06	0.1038E 06	0.1357E 06	0.1088E 08
20.50	0.1085E 01	0.3800E 03	0.8449E 05	0.1091E 06	0.1091E 06	0.1425E 06	0.1143E 08
21.00	0.1084E 01	0.3799E 03	0.8867E 05	0.1145E 06	0.1145E 06	0.1496E 06	0.1199E 08
21.50	0.1090E 01	0.3799E 03	0.9296E 05	0.1200E 06	0.1200E 06	0.1568E 06	0.1257E 08
22.00	0.1095E 01	0.3798E 03	0.9734E 05	0.1256E 06	0.1256E 06	0.1641E 06	0.1316E 08
22.50	0.1093E 01	0.3798E 03	0.1018E 06	0.1314E 06	0.1314E 06	0.1717E 06	0.1377E 08
23.00	0.1090E 01	0.3798E 03	0.1064E 06	0.1373E 06	0.1373E 06	0.1794E 06	0.1438E 08
23.50	0.1098E 01	0.3797E 03	0.1111E 06	0.1433E 06	0.1433E 06	0.1873E 06	0.1502E 08
24.00	0.1106E 01	0.3797E 03	0.1159E 06	0.1495E 06	0.1495E 06	0.1953E 06	0.1566E 08
24.50	0.1099E 01	0.3797E 03	0.1208E 06	0.1558E 06	0.1558E 06	0.2035E 06	0.1632E 08
25.00	0.1093E 01	0.3796E 03	0.1257E 06	0.1622E 06	0.1622E 06	0.2119E 06	0.1699E 08
25.50	0.1105E 01	0.3796E 03	0.1308E 06	0.1688E 06	0.1688E 06	0.2205E 06	0.1768E 08
26.00	0.1116E 01	0.3796E 03	0.1360E 06	0.1754E 06	0.1754E 06	0.2292E 06	0.1838E 08
26.50	0.1115E 01	0.3795E 03	0.1413E 06	0.1822E 06	0.1822E 06	0.2381E 06	0.1909E 08
27.00	0.1114E 01	0.3795E 03	0.1467E 06	0.1892E 06	0.1892E 06	0.2472E 06	0.1982E 08
27.50	0.1118E 01	0.3795E 03	0.1522E 06	0.1963E 06	0.1963E 06	0.2564E 06	0.2056E 08
28.00	0.1121E 01	0.3794E 03	0.1578E 06	0.2035E 06	0.2035E 06	0.2658E 06	0.2131E 08
28.50	0.1109E 01	0.3794E 03	0.1635E 06	0.2108E 06	0.2108E 06	0.2754E 06	0.2208E 08
29.00	0.1098E 01	0.3793E 03	0.1693E 06	0.2182E 06	0.2182E 06	0.2851E 06	0.2286E 08
29.50	0.1107E 01	0.3793E 03	0.1751E 06	0.2258E 06	0.2258E 06	0.2950E 06	0.2366E 08
30.00	0.1117E 01	0.3793E 03	0.1811E 06	0.2335E 06	0.2335E 06	0.3051E 06	0.2446E 08
30.50	0.1126E 01	0.3792E 03	0.1872E 06	0.2414E 06	0.2414E 06	0.3154E 06	0.2529E 08
31.00	0.1134E 01	0.3792E 03	0.1934E 06	0.2494E 06	0.2494E 06	0.3258E 06	0.2612E 08
31.50	0.1121E 01	0.3792E 03	0.1997E 06	0.2575E 06	0.2575E 06	0.3364E 06	0.2697E 08
32.00	0.1108E 01	0.3791E 03	0.2061E 06	0.2657E 06	0.2657E 06	0.3471E 06	0.2783E 08
32.50	0.1129E 01	0.3791E 03	0.2126E 06	0.2741E 06	0.2741E 06	0.3581E 06	0.2871E 08
33.00	0.1150E 01	0.3791E 03	0.2192E 06	0.2826E 06	0.2826E 06	0.3692E 06	0.2960E 08
33.50	0.1143E 01	0.3790E 03	0.2259E 06	0.2912E 06	0.2912E 06	0.3804E 06	0.3050E 08
34.00	0.1137E 01	0.3790E 03	0.2327E 06	0.2999E 06	0.2999E 06	0.3919E 06	0.3142E 08

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 10.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.	0.	0.1013E 01	0.1915E 01	0.6290E 03	0.8196E 03	0.8128E 05
1.04	0.1010E 01	0.	0.3452E 03	0.6518E 03	0.6518E 03	0.8492E 03	0.8422E 05
1.07	0.1008E 01	0.	0.3578E 03	0.6756E 03	0.6756E 03	0.8802E 03	0.8730E 05
1.10	0.1007E 01	0.	0.3704E 03	0.7005E 03	0.7005E 03	0.9127E 03	0.9052E 05
1.20	0.1006E 01	0.	0.4201E 03	0.7907E 03	0.7907E 03	0.1030E 04	0.1022E 06
1.30	0.1005E 01	0.	0.4782E 03	0.8912E 03	0.8912E 03	0.1161E 04	0.1152E 06
1.40	0.1005E 01	0.	0.5449E 03	0.1001E 04	0.1001E 04	0.1305E 04	0.1294E 06
1.50	0.1005E 01	0.6131E 03	0.6206E 03	0.1121E 04	0.1121E 04	0.1461E 04	0.1449E 06
1.60	0.1005E 01	0.6224E 03	0.7051E 03	0.1250E 04	0.1250E 04	0.1628E 04	0.1615E 06
1.70	0.1005E 01	0.6230E 03	0.7984E 03	0.1387E 04	0.1387E 04	0.1807E 04	0.1793E 06
1.80	0.1006E 01	0.6236E 03	0.9002E 03	0.1534E 04	0.1534E 04	0.1998E 04	0.1982E 06
1.90	0.1006E 01	0.6241E 03	0.1010E 04	0.1689E 04	0.1689E 04	0.2200E 04	0.2182E 06
2.00	0.1006E 01	0.6247E 03	0.1129E 04	0.1853E 04	0.1853E 04	0.2414E 04	0.2394E 06
2.20	0.1006E 01	0.6247E 03	0.1389E 04	0.2206E 04	0.2206E 04	0.2874E 04	0.2850E 06
2.40	0.1007E 01	0.6243E 03	0.1679E 04	0.2594E 04	0.2594E 04	0.3379E 04	0.3351E 06
2.60	0.1007E 01	0.6239E 03	0.1998E 04	0.3015E 04	0.3015E 04	0.3929E 04	0.3896E 06
2.80	0.1008E 01	0.6236E 03	0.2345E 04	0.3471E 04	0.3471E 04	0.4523E 04	0.4486E 06
3.00	0.1008E 01	0.6232E 03	0.2720E 04	0.3961E 04	0.3961E 04	0.5161E 04	0.5119E 06
3.20	0.1009E 01	0.6228E 03	0.3122E 04	0.4485E 04	0.4485E 04	0.5844E 04	0.5795E 06
3.40	0.1009E 01	0.6225E 03	0.3552E 04	0.5043E 04	0.5043E 04	0.6570E 04	0.6516E 06
3.60	0.1010E 01	0.6221E 03	0.4009E 04	0.5634E 04	0.5634E 04	0.7341E 04	0.7281E 06
3.80	0.1010E 01	0.6218E 03	0.4492E 04	0.6260E 04	0.6260E 04	0.8156E 04	0.8089E 06
4.00	0.1011E 01	0.6214E 03	0.5002E 04	0.6919E 04	0.6919E 04	0.9015E 04	0.8941E 06
4.20	0.1011E 01	0.6214E 03	0.5539E 04	0.7613E 04	0.7613E 04	0.9919E 04	0.9837E 06
4.40	0.1012E 01	0.6213E 03	0.6102E 04	0.8340E 04	0.8340E 04	0.1087E 05	0.1078E 07
4.60	0.1012E 01	0.6213E 03	0.6692E 04	0.9101E 04	0.9101E 04	0.1186E 05	0.1176E 07
4.80	0.1013E 01	0.6213E 03	0.7308E 04	0.9896E 04	0.9896E 04	0.1289E 05	0.1279E 07
5.00	0.1013E 01	0.6213E 03	0.7950E 04	0.1072E 05	0.1072E 05	0.1397E 05	0.1386E 07

DESIGN JET MACH NUMBER = 10.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1013E 01	0.6213E 03	0.7950E 04	0.1072E 05	0.1072E 05	0.1397E 05	0.1386E 07
5.50	0.1015E 01	0.6212E 03	0.9672E 04	0.1294E 05	0.1294E 05	0.1687E 05	0.1673E 07
6.00	0.1016E 01	0.6212E 03	0.1156E 05	0.1538E 05	0.1538E 05	0.2003E 05	0.1987E 07
6.50	0.1017E 01	0.6211E 03	0.1361E 05	0.1802E 05	0.1802E 05	0.2348E 05	0.2328E 07
7.00	0.1018E 01	0.6210E 03	0.1583E 05	0.2087E 05	0.2087E 05	0.2720E 05	0.2697E 07
7.50	0.1019E 01	0.6210E 03	0.1821E 05	0.2394E 05	0.2394E 05	0.3119E 05	0.3093E 07
8.00	0.1021E 01	0.6209E 03	0.2075E 05	0.2722E 05	0.2722E 05	0.3546E 05	0.3517E 07
8.50	0.1022E 01	0.6209E 03	0.2346E 05	0.3070E 05	0.3070E 05	0.4000E 05	0.3968E 07
9.00	0.1023E 01	0.6208E 03	0.2633E 05	0.3440E 05	0.3440E 05	0.4483E 05	0.4446E 07
9.50	0.1024E 01	0.6207E 03	0.2937E 05	0.3832E 05	0.3832E 05	0.4992E 05	0.4951E 07
10.00	0.1025E 01	0.6207E 03	0.3257E 05	0.4244E 05	0.4244E 05	0.5529E 05	0.5484E 07
10.50	0.1026E 01	0.6206E 03	0.3594E 05	0.4677E 05	0.4677E 05	0.6094E 05	0.6044E 07
11.00	0.1027E 01	0.6206E 03	0.3947E 05	0.5132E 05	0.5132E 05	0.6686E 05	0.6631E 07
11.50	0.1028E 01	0.6205E 03	0.4316E 05	0.5608E 05	0.5608E 05	0.7306E 05	0.7246E 07
12.00	0.1030E 01	0.6205E 03	0.4702E 05	0.6105E 05	0.6105E 05	0.7954E 05	0.7888E 07
12.50	0.1030E 01	0.6204E 03	0.5105E 05	0.6623E 05	0.6623E 05	0.8629E 05	0.8558E 07
13.00	0.1031E 01	0.6203E 03	0.5523E 05	0.7162E 05	0.7162E 05	0.9331E 05	0.9254E 07
13.50	0.1032E 01	0.6203E 03	0.5959E 05	0.7722E 05	0.7722E 05	0.1006E 06	0.9978E 07
14.00	0.1033E 01	0.6202E 03	0.6410E 05	0.8304E 05	0.8304E 05	0.1082E 06	0.1073E 08
14.50	0.1035E 01	0.6202E 03	0.6878E 05	0.8906E 05	0.8906E 05	0.1160E 06	0.1151E 08
15.00	0.1037E 01	0.6201E 03	0.7363E 05	0.9530E 05	0.9530E 05	0.1242E 06	0.1231E 08
15.50	0.1036E 01	0.6200E 03	0.7863E 05	0.1017E 06	0.1017E 06	0.1326E 06	0.1315E 08
16.00	0.1035E 01	0.6200E 03	0.8381E 05	0.1084E 06	0.1084E 06	0.1412E 06	0.1401E 08
16.50	0.1039E 01	0.6199E 03	0.8914E 05	0.1153E 06	0.1153E 06	0.1502E 06	0.1490E 08
17.00	0.1044E 01	0.6199E 03	0.9464E 05	0.1224E 06	0.1224E 06	0.1594E 06	0.1581E 08
17.50	0.1045E 01	0.6198E 03	0.1003E 06	0.1297E 06	0.1297E 06	0.1689E 06	0.1675E 08
18.00	0.1046E 01	0.6197E 03	0.1061E 06	0.1372E 06	0.1372E 06	0.1787E 06	0.1772E 08
18.50	0.1048E 01	0.6197E 03	0.1121E 06	0.1449E 06	0.1449E 06	0.1888E 06	0.1872E 08
19.00	0.1049E 01	0.6196E 03	0.1183E 06	0.1528E 06	0.1528E 06	0.1991E 06	0.1975E 08
19.50	0.1050E 01	0.6196E 03	0.1246E 06	0.1610E 06	0.1610E 06	0.2097E 06	0.2080E 08

DESIGN JET MACH NUMBER = 10.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.1050E 01	0.6196E 03	0.1246E 06	0.1610E 06	0.1610E 06	0.2097E 06	0.2080E 08
20.00	0.1051E 01	0.6195E 03	0.1311E 06	0.1693E 06	0.1693E 06	0.2206E 06	0.2188E 08
20.50	0.1047E 01	0.6194E 03	0.1378E 06	0.1779E 06	0.1779E 06	0.2317E 06	0.2298E 08
21.00	0.1043E 01	0.6194E 03	0.1446E 06	0.1866E 06	0.1866E 06	0.2432E 06	0.2412E 08
21.50	0.1049E 01	0.6193E 03	0.1515E 06	0.1956E 06	0.1956E 06	0.2549E 06	0.2528E 08
22.00	0.1056E 01	0.6193E 03	0.1587E 06	0.2048E 06	0.2048E 06	0.2669E 06	0.2647E 08
22.50	0.1047E 01	0.6192E 03	0.1660E 06	0.2142E 06	0.2142E 06	0.2791E 06	0.2768E 08
23.00	0.1038E 01	0.6192E 03	0.1735E 06	0.2239E 06	0.2239E 06	0.2917E 06	0.2893E 08
23.50	0.1049E 01	0.6191E 03	0.1811E 06	0.2337E 06	0.2337E 06	0.3045E 06	0.3020E 08
24.00	0.1060E 01	0.6190E 03	0.1889E 06	0.2437E 06	0.2437E 06	0.3176E 06	0.3149E 08
24.50	0.1063E 01	0.6190E 03	0.1969E 06	0.2540E 06	0.2540E 06	0.3309E 06	0.3282E 08
25.00	0.1065E 01	0.6189E 03	0.2050E 06	0.2644E 06	0.2644E 06	0.3446E 06	0.3417E 08
25.50	0.1065E 01	0.6189E 03	0.2133E 06	0.2751E 06	0.2751E 06	0.3585E 06	0.3555E 08
26.00	0.1064E 01	0.6188E 03	0.2217E 06	0.2860E 06	0.2860E 06	0.3727E 06	0.3696E 08
26.50	0.1057E 01	0.6187E 03	0.2304E 06	0.2971E 06	0.2971E 06	0.3871E 06	0.3839E 08
27.00	0.1050E 01	0.6187E 03	0.2392E 06	0.3084E 06	0.3084E 06	0.4019E 06	0.3985E 08
27.50	0.1052E 01	0.6186E 03	0.2481E 06	0.3200E 06	0.3200E 06	0.4169E 06	0.4134E 08
28.00	0.1055E 01	0.6186E 03	0.2572E 06	0.3317E 06	0.3317E 06	0.4322E 06	0.4286E 08
28.50	0.1059E 01	0.6185E 03	0.2665E 06	0.3436E 06	0.3436E 06	0.4477E 06	0.4440E 08
29.00	0.1064E 01	0.6184E 03	0.2759E 06	0.3558E 06	0.3558E 06	0.4636E 06	0.4597E 08
29.50	0.1047E 01	0.6184E 03	0.2855E 06	0.3682E 06	0.3682E 06	0.4797E 06	0.4757E 08
30.00	0.1030E 01	0.6183E 03	0.2953E 06	0.3807E 06	0.3807E 06	0.4961E 06	0.4920E 08
30.50	0.1038E 01	0.6183E 03	0.3053E 06	0.3935E 06	0.3935E 06	0.5127E 06	0.5085E 08
31.00	0.1046E 01	0.6182E 03	0.3154E 06	0.4065E 06	0.4065E 06	0.5297E 06	0.5253E 08
31.50	0.1059E 01	0.6181E 03	0.3256E 06	0.4198E 06	0.4198E 06	0.5469E 06	0.5424E 08
32.00	0.1073E 01	0.6181E 03	0.3360E 06	0.4332E 06	0.4332E 06	0.5644E 06	0.5597E 08
32.50	0.1065E 01	0.6180E 03	0.3466E 06	0.4468E 06	0.4468E 06	0.5822E 06	0.5774E 08
33.00	0.1056E 01	0.6180E 03	0.3574E 06	0.4607E 06	0.4607E 06	0.6002E 06	0.5953E 08
33.50	0.1055E 01	0.6179E 03	0.3683E 06	0.4747E 06	0.4747E 06	0.6185E 06	0.6134E 08
34.00	0.1054E 01	0.6178E 03	0.3794E 06	0.4890E 06	0.4890E 06	0.6371E 06	0.6319E 08

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 12.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.	0.	0.1013E 01	0.1915E 01	0.1489E 04	0.1932E 04	0.2767E 06
1.04	0.1004E 01	0.	0.8169E 03	0.1542E 04	0.1542E 04	0.2002E 04	0.2867E 06
1.07	0.1003E 01	0.	0.8467E 03	0.1599E 04	0.1599E 04	0.2076E 04	0.2972E 06
1.10	0.1003E 01	0.	0.8766E 03	0.1658E 04	0.1658E 04	0.2152E 04	0.3081E 06
1.20	0.1002E 01	0.	0.9942E 03	0.1871E 04	0.1871E 04	0.2429E 04	0.3478E 06
1.30	0.1002E 01	0.	0.1132E 04	0.2109E 04	0.2109E 04	0.2738E 04	0.3920E 06
1.40	0.1002E 01	0.	0.1290E 04	0.2370E 04	0.2370E 04	0.3077E 04	0.4405E 06
1.50	0.1002E 01	0.1451E 04	0.1469E 04	0.2653E 04	0.2653E 04	0.3444E 04	0.4931E 06
1.60	0.1002E 01	0.1473E 04	0.1669E 04	0.2957E 04	0.2957E 04	0.3839E 04	0.5497E 06
1.70	0.1002E 01	0.1474E 04	0.1889E 04	0.3283E 04	0.3283E 04	0.4262E 04	0.6102E 06
1.80	0.1002E 01	0.1476E 04	0.2130E 04	0.3629E 04	0.3629E 04	0.4712E 04	0.6746E 06
1.90	0.1002E 01	0.1477E 04	0.2391E 04	0.3996E 04	0.3996E 04	0.5188E 04	0.7428E 06
2.00	0.1003E 01	0.1478E 04	0.2671E 04	0.4384E 04	0.4384E 04	0.5691E 04	0.8148E 06
2.20	0.1003E 01	0.1478E 04	0.3286E 04	0.5220E 04	0.5220E 04	0.6777E 04	0.9703E 06
2.40	0.1003E 01	0.1477E 04	0.3972E 04	0.6138E 04	0.6138E 04	0.7968E 04	0.1141E 07
2.60	0.1003E 01	0.1477E 04	0.4727E 04	0.7136E 04	0.7136E 04	0.9264E 04	0.1326E 07
2.80	0.1003E 01	0.1476E 04	0.5549E 04	0.8215E 04	0.8215E 04	0.1066E 05	0.1527E 07
3.00	0.1003E 01	0.1475E 04	0.6437E 04	0.9374E 04	0.9374E 04	0.1217E 05	0.1742E 07
3.20	0.1004E 01	0.1474E 04	0.7389E 04	0.1061E 05	0.1061E 05	0.1378E 05	0.1973E 07
3.40	0.1004E 01	0.1473E 04	0.8406E 04	0.1193E 05	0.1193E 05	0.1549E 05	0.2218E 07
3.60	0.1004E 01	0.1472E 04	0.9486E 04	0.1333E 05	0.1333E 05	0.1731E 05	0.2478E 07
3.80	0.1004E 01	0.1471E 04	0.1063E 05	0.1481E 05	0.1481E 05	0.1923E 05	0.2754E 07
4.00	0.1004E 01	0.1471E 04	0.1184E 05	0.1637E 05	0.1637E 05	0.2126E 05	0.3044E 07
4.20	0.1005E 01	0.1470E 04	0.1311E 05	0.1802E 05	0.1802E 05	0.2339E 05	0.3349E 07
4.40	0.1005E 01	0.1470E 04	0.1444E 05	0.1974E 05	0.1974E 05	0.2562E 05	0.3668E 07
4.60	0.1005E 01	0.1470E 04	0.1584E 05	0.2154E 05	0.2154E 05	0.2796E 05	0.4003E 07
4.80	0.1005E 01	0.1470E 04	0.1729E 05	0.2342E 05	0.2342E 05	0.3040E 05	0.4353E 07
5.00	0.1005E 01	0.1470E 04	0.1881E 05	0.2538E 05	0.2538E 05	0.3295E 05	0.4717E 07

DESIGN JET MACH NUMBER = 12.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1005E 01	0.1470E 04	0.1881E 05	0.2538E 05	0.2538E 05	0.3295E 05	0.4717E 07
5.50	0.1006E 01	0.1470E 04	0.2289E 05	0.3063E 05	0.3063E 05	0.3977E 05	0.5694E 07
6.00	0.1006E 01	0.1470E 04	0.2735E 05	0.3639E 05	0.3639E 05	0.4724E 05	0.6763E 07
6.50	0.1007E 01	0.1470E 04	0.3221E 05	0.4264E 05	0.4264E 05	0.5536E 05	0.7926E 07
7.00	0.1007E 01	0.1470E 04	0.3745E 05	0.4939E 05	0.4939E 05	0.6413E 05	0.9181E 07
7.50	0.1008E 01	0.1470E 04	0.4309E 05	0.5665E 05	0.5665E 05	0.7354E 05	0.1053E 08
8.00	0.1008E 01	0.1469E 04	0.4911E 05	0.6441E 05	0.6441E 05	0.8361E 05	0.1197E 08
8.50	0.1008E 01	0.1469E 04	0.5552E 05	0.7266E 05	0.7266E 05	0.9433E 05	0.1351E 08
9.00	0.1009E 01	0.1469E 04	0.6232E 05	0.8142E 05	0.8142E 05	0.1057E 06	0.1513E 08
9.50	0.1008E 01	0.1469E 04	0.6951E 05	0.9067E 05	0.9067E 05	0.1177E 06	0.1685E 08
10.00	0.1007E 01	0.1469E 04	0.7708E 05	0.1004E 06	0.1004E 06	0.1304E 06	0.1867E 08
10.50	0.1005E 01	0.1469E 04	0.8505E 05	0.1107E 06	0.1107E 06	0.1437E 06	0.2057E 08
11.00	0.1003E 01	0.1469E 04	0.9340E 05	0.1214E 06	0.1214E 06	0.1577E 06	0.2257E 08
11.50	0.1008E 01	0.1468E 04	0.1021E 06	0.1327E 06	0.1327E 06	0.1723E 06	0.2467E 08
12.00	0.1012E 01	0.1468E 04	0.1113E 06	0.1445E 06	0.1445E 06	0.1875E 06	0.2685E 08
12.50	0.1011E 01	0.1468E 04	0.1208E 06	0.1567E 06	0.1567E 06	0.2035E 06	0.2913E 08
13.00	0.1009E 01	0.1468E 04	0.1307E 06	0.1695E 06	0.1695E 06	0.2200E 06	0.3150E 08
13.50	0.1006E 01	0.1468E 04	0.1410E 06	0.1827E 06	0.1827E 06	0.2372E 06	0.3397E 08
14.00	0.1004E 01	0.1468E 04	0.1517E 06	0.1965E 06	0.1965E 06	0.2551E 06	0.3652E 08
14.50	0.1007E 01	0.1468E 04	0.1628E 06	0.2108E 06	0.2108E 06	0.2736E 06	0.3917E 08
15.00	0.1010E 01	0.1467E 04	0.1742E 06	0.2255E 06	0.2255E 06	0.2928E 06	0.4192E 08
15.50	0.1013E 01	0.1467E 04	0.1861E 06	0.2408E 06	0.2408E 06	0.3126E 06	0.4475E 08
16.00	0.1017E 01	0.1467E 04	0.1983E 06	0.2565E 06	0.2565E 06	0.3330E 06	0.4768E 08
16.50	0.1014E 01	0.1467E 04	0.2110E 06	0.2728E 06	0.2728E 06	0.3542E 06	0.5071E 08
17.00	0.1012E 01	0.1467E 04	0.2240E 06	0.2896E 06	0.2896E 06	0.3759E 06	0.5382E 08
17.50	0.1009E 01	0.1467E 04	0.2374E 06	0.3068E 06	0.3068E 06	0.3983E 06	0.5703E 08
18.00	0.1006E 01	0.1467E 04	0.3274E 06	0.4230E 06	0.2501E 06	0.3247E 06	0.6033E 0C
18.50	0.1006E 01	0.1466E 04	0.3483E 06	0.4500E 06	0.2623E 06	0.3406E 06	0.6373E 08
19.00	0.1006E 01	0.1466E 04	0.3689E 06	0.4766E 06	0.2756E 06	0.3578E 06	0.6721E 08
19.50	0.1011E 01	0.1466E 04	0.3899E 06	0.5036E 06	0.2894E 06	0.3757E 06	0.7079E 08

DESIGN JET MACH NUMBER = 12.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.1011E 01	0.1466E 04	0.3899E 06	0.5036E 06	0.2894E 06	0.3757E 06	0.7079E 08
20.00	0.1016E 01	0.1466E 04	0.4112E 06	0.5311E 06	0.3037E 06	0.3943E 06	0.7447E 08
20.50	0.1027E 01	0.1466E 04	0.4330E 06	0.5591E 06	0.3184E 06	0.4134E 06	0.7823E 08
21.00	0.1038E 01	0.1466E 04	0.4553E 06	0.5878E 06	0.3336E 06	0.4330E 06	0.8209E 08
21.50	0.1032E 01	0.1466E 04	0.4781E 06	0.6172E 06	0.3491E 06	0.4532E 06	0.8605E 08
22.00	0.1025E 01	0.1465E 04	0.5014E 06	0.6471E 06	0.3650E 06	0.4738E 06	0.9009E 08
22.50	0.1016E 01	0.1465E 04	0.5252E 06	0.6778E 06	0.3813E 06	0.4950E 06	0.9423E 08
23.00	0.1006E 01	0.1465E 04	0.5495E 06	0.7091E 06	0.3980E 06	0.5167E 06	0.9846E 08
23.50	0.1020E 01	0.1465E 04	0.5743E 06	0.7410E 06	0.4150E 06	0.5388E 06	0.1028E 09
24.00	0.1035E 01	0.1465E 04	0.5996E 06	0.7736E 06	0.4325E 06	0.5615E 06	0.1072E 09
24.50	0.1035E 01	0.1465E 04	0.6255E 06	0.8069E 06	0.4503E 06	0.5846E 06	0.1117E 09
25.00	0.1036E 01	0.1465E 04	0.6519E 06	0.8409E 06	0.4685E 06	0.6082E 06	0.1163E 09
25.50	0.1041E 01	0.1465E 04	0.6788E 06	0.8756E 06	0.4871E 06	0.6323E 06	0.1210E 09
26.00	0.1047E 01	0.1464E 04	0.7062E 06	0.9109E 06	0.5060E 06	0.6569E 06	0.1258E 09
26.50	0.1057E 01	0.1464E 04	0.7342E 06	0.9469E 06	0.5253E 06	0.6820E 06	0.1307E 09
27.00	0.1067E 01	0.1464E 04	0.7627E 06	0.9836E 06	0.5450E 06	0.7075E 06	0.1357E 09
27.50	0.1068E 01	0.1464E 04	0.7917E 06	0.1021E 07	0.5651E 06	0.7336E 06	0.1407E 09
28.00	0.1070E 01	0.1464E 04	0.8212E 06	0.1059E 07	0.5855E 06	0.7601E 06	0.1459E 09
28.50	0.1069E 01	0.1464E 04	0.8513E 06	0.1098E 07	0.6063E 06	0.7871E 06	0.1511E 09
29.00	0.1068E 01	0.1464E 04	0.8819E 06	0.1137E 07	0.6275E 06	0.8146E 06	0.1565E 09
29.50	0.1057E 01	0.1463E 04	0.9130E 06	0.1177E 07	0.6490E 06	0.8426E 06	0.1619E 09
30.00	0.1045E 01	0.1463E 04	0.9447E 06	0.1218E 07	0.6709E 06	0.8710E 06	0.1675E 09
30.50	0.1036E 01	0.1463E 04	0.9768E 06	0.1259E 07	0.6932E 06	0.9000E 06	0.1731E 09
31.00	0.1027E 01	0.1463E 04	0.1010E 07	0.1301E 07	0.7159E 06	0.9294E 06	0.1788E 09
31.50	0.1055E 01	0.1463E 04	0.1043E 07	0.1344E 07	0.7389E 06	0.9593E 06	0.1846E 09
32.00	0.1083E 01	0.1463E 04	0.1077E 07	0.1388E 07	0.7623E 06	0.9896E 06	0.1905E 09
32.50	0.1092E 01	0.1463E 04	0.1111E 07	0.1432E 07	0.7861E 06	0.1021E 07	0.1965E 09
33.00	0.1101E 01	0.1462E 04	0.1146E 07	0.1477E 07	0.8102E 06	0.1052E 07	0.2026E 09
33.50	0.1079E 01	0.1462E 04	0.1181E 07	0.1522E 07	0.8347E 06	0.1084E 07	0.2088E 09
34.00	0.1058E 01	0.1462E 04	0.1217E 07	0.1569E 07	0.8596E 06	0.1116E 07	0.2151E 09

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 14.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.1004E 01	0.	0.1650E 04	0.3120E 04	0.3120E 04	0.4042E 04	0.7889E 06
1.04	0.1002E 01	0.	0.1712E 04	0.3233E 04	0.3233E 04	0.4188E 04	0.8174E 06
1.07	0.1001E 01	0.	0.1775E 04	0.3351E 04	0.3351E 04	0.4341E 04	0.8473E 06
1.10	0.1001E 01	0.	0.1837E 04	0.3475E 04	0.3475E 04	0.4501E 04	0.8785E 06
1.20	0.1001E 01	0.	0.2084E 04	0.3922E 04	0.3922E 04	0.5081E 04	0.9916E 06
1.30	0.1001E 01	0.	0.2372E 04	0.4421E 04	0.4421E 04	0.5727E 04	0.1118E 07
1.40	0.1001E 01	0.	0.2703E 04	0.4968E 04	0.4968E 04	0.6435E 04	0.1256E 07
1.50	0.1001E 01	0.3041E 04	0.3078E 04	0.5561E 04	0.5561E 04	0.7204E 04	0.1406E 07
1.60	0.1001E 01	0.3088E 04	0.3498E 04	0.6199E 04	0.6199E 04	0.8030E 04	0.1567E 07
1.70	0.1001E 01	0.3090E 04	0.3960E 04	0.6881E 04	0.6881E 04	0.8914E 04	0.1740E 07
1.80	0.1001E 01	0.3093E 04	0.4466E 04	0.7608E 04	0.7608E 04	0.9855E 04	0.1923E 07
1.90	0.1001E 01	0.3096E 04	0.5012E 04	0.8377E 04	0.8377E 04	0.1085E 05	0.2118E 07
2.00	0.1001E 01	0.3099E 04	0.5599E 04	0.9189E 04	0.9189E 04	0.1190E 05	0.2323E 07
2.20	0.1001E 01	0.3099E 04	0.6888E 04	0.1094E 05	0.1094E 05	0.1417E 05	0.2767E 07
2.40	0.1001E 01	0.3097E 04	0.8327E 04	0.1287E 05	0.1287E 05	0.1667E 05	0.3253E 07
2.60	0.1001E 01	0.3095E 04	0.9909E 04	0.1496E 05	0.1496E 05	0.1938E 05	0.3782E 07
2.80	0.1001E 01	0.3093E 04	0.1163E 05	0.1722E 05	0.1722E 05	0.2231E 05	0.4354E 07
3.00	0.1001E 01	0.3091E 04	0.1349E 05	0.1965E 05	0.1965E 05	0.2545E 05	0.4968E 07
3.20	0.1002E 01	0.3090E 04	0.1549E 05	0.2225E 05	0.2225E 05	0.2882E 05	0.5625E 07
3.40	0.1002E 01	0.3088E 04	0.1762E 05	0.2502E 05	0.2502E 05	0.3240E 05	0.6324E 07
3.60	0.1001E 01	0.3086E 04	0.1988E 05	0.2795E 05	0.2795E 05	0.3621E 05	0.7066E 07
3.80	0.1001E 01	0.3084E 04	0.2228E 05	0.3105E 05	0.3105E 05	0.4023E 05	0.7851E 07
4.00	0.1002E 01	0.3082E 04	0.2481E 05	0.3432E 05	0.3432E 05	0.4446E 05	0.8678E 07
4.20	0.1002E 01	0.3082E 04	0.2747E 05	0.3776E 05	0.3776E 05	0.4892E 05	0.9547E 07
4.40	0.1002E 01	0.3082E 04	0.3027E 05	0.4137E 05	0.4137E 05	0.5359E 05	0.1046E 08
4.60	0.1002E 01	0.3082E 04	0.3319E 05	0.4515E 05	0.4515E 05	0.5848E 05	0.1141E 08
4.80	0.1001E 01	0.3082E 04	0.3625E 05	0.4909E 05	0.4909E 05	0.6359E 05	0.1241E 08
5.00	0.1002E 01	0.3082E 04	0.3944E 05	0.5320E 05	0.5320E 05	0.6891E 05	0.1345E 08

DESIGN JET MACH NUMBER = 14.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1002E 01	0.3082E 04	0.3944E 05	0.5320E 05	0.5320E 05	0.6891E 05	0.1345E 08
5.50	0.1002E 01	0.3082E 04	0.4798E 05	0.6421E 05	0.6421E 05	0.8318E 05	0.1623E 08
6.00	0.1002E 01	0.3081E 04	0.5734E 05	0.7627E 05	0.7627E 05	0.9880E 05	0.1928E 08
6.50	0.1002E 01	0.3081E 04	0.6751E 05	0.8938E 05	0.8938E 05	0.1158E 06	0.2260E 08
7.00	0.1001E 01	0.3081E 04	0.7851E 05	0.1035E 06	0.1035E 06	0.1341E 06	0.2618E 08
7.50	0.1003E 01	0.3080E 04	0.9031E 05	0.1187E 06	0.1187E 06	0.1538E 06	0.3002E 08
8.00	0.1005E 01	0.3080E 04	0.1029E 06	0.1350E 06	0.1350E 06	0.1749E 06	0.3413E 08
8.50	0.1005E 01	0.3080E 04	0.1164E 06	0.1523E 06	0.1523E 06	0.1973E 06	0.3851E 08
9.00	0.1006E 01	0.3080E 04	0.1306E 06	0.1707E 06	0.1707E 06	0.2211E 06	0.4315E 08
9.50	0.1005E 01	0.3079E 04	0.1457E 06	0.1901E 06	0.1901E 06	0.2462E 06	0.4805E 08
10.00	0.1004E 01	0.3079E 04	0.1616E 06	0.2105E 06	0.2105E 06	0.2727E 06	0.5322E 08
10.50	0.1006E 01	0.3079E 04	0.1783E 06	0.2320E 06	0.2320E 06	0.3006E 06	0.5866E 08
11.00	0.1008E 01	0.3078E 04	0.1958E 06	0.2546E 06	0.2546E 06	0.3298E 06	0.6436E 08
11.50	0.1011E 01	0.3078E 04	0.2141E 06	0.2782E 06	0.2782E 06	0.3603E 06	0.7033E 08
12.00	0.1013E 01	0.3078E 04	0.2333E 06	0.3028E 06	0.3028E 06	0.3923E 06	0.7656E 08
12.50	0.1010E 01	0.3077E 04	0.2532E 06	0.3285E 06	0.3285E 06	0.4256E 06	0.8306E 08
13.00	0.1007E 01	0.3077E 04	0.2740E 06	0.3553E 06	0.3553E 06	0.4602E 06	0.8982E 08
13.50	0.1010E 01	0.3077E 04	0.2956E 06	0.3831E 06	0.3831E 06	0.4962E 06	0.9685E 08
14.00	0.1012E 01	0.3077E 04	0.3180E 06	0.4119E 06	0.4119E 06	0.5336E 06	0.1041E 09
14.50	0.1011E 01	0.3076E 04	0.4469E 06	0.5787E 06	0.3374E 06	0.4370E 06	0.1117E 09
15.00	0.1010E 01	0.3076E 04	0.4821E 06	0.6240E 06	0.3584E 06	0.4642E 06	0.1195E 09
15.50	0.1016E 01	0.3076E 04	0.5176E 06	0.6697E 06	0.3808E 06	0.4933E 06	0.1276E 09
16.00	0.1022E 01	0.3075E 04	0.5538E 06	0.7164E 06	0.4042E 06	0.5236E 06	0.1360E 09
16.50	0.1017E 01	0.3075E 04	0.5911E 06	0.7644E 06	0.4285E 06	0.5551E 06	0.1446E 09
17.00	0.1011E 01	0.3075E 04	0.6293E 06	0.8136E 06	0.4537E 06	0.5877E 06	0.1535E 09
17.50	0.1014E 01	0.3075E 04	0.6686E 06	0.8642E 06	0.4796E 06	0.6213E 06	0.1626E 09
18.00	0.1017E 01	0.3074E 04	0.7090E 06	0.9162E 06	0.5064E 06	0.6560E 06	0.1720E 09
18.50	0.1018E 01	0.3074E 04	0.7505E 06	0.9696E 06	0.5340E 06	0.6917E 06	0.1817E 09
19.00	0.1019E 01	0.3074E 04	0.7930E 06	0.1024E 07	0.5624E 06	0.7285E 06	0.1916E 09
19.50	0.1023E 01	0.3073E 04	0.8367E 06	0.1081E 07	0.5915E 06	0.7662E 06	0.2019E 09

DESIGN JET MACH NUMBER = 14.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.1023E 01	0.3073E 04	0.8367E 06	0.1081E 07	0.5915E 06	0.7662E 06	0.2019E 09
20.00	0.1026E 01	0.3073E 04	0.8815E 06	0.1138E 07	0.6214E 06	0.8050E 06	0.2123E 09
20.50	0.1018E 01	0.3073E 04	0.9274E 06	0.1197E 07	0.6521E 06	0.8448E 06	0.2231E 09
21.00	0.1010E 01	0.3072E 04	0.9744E 06	0.1258E 07	0.6836E 06	0.8855E 06	0.2341E 09
21.50	0.1022E 01	0.3072E 04	0.1022E 07	0.1320E 07	0.7159E 06	0.9273E 06	0.2453E 09
22.00	0.1034E 01	0.3072E 04	0.1072E 07	0.1383E 07	0.7489E 06	0.9701E 06	0.2569E 09
22.50	0.1029E 01	0.3072E 04	0.1122E 07	0.1448E 07	0.7826E 06	0.1014E 07	0.2687E 09
23.00	0.1024E 01	0.3071E 04	0.1174E 07	0.1514E 07	0.8172E 06	0.1059E 07	0.2807E 09
23.50	0.1034E 01	0.3071E 04	0.1226E 07	0.1582E 07	0.8525E 06	0.1104E 07	0.2931E 09
24.00	0.1043E 01	0.3071E 04	0.1280E 07	0.1651E 07	0.8886E 06	0.1151E 07	0.3057E 09
24.50	0 1044E 01	0.3070E 04	0.1335E 07	0.1722E 07	0.9254E 06	0.1199E 07	0.3185E 09
25.00	0.1045E 01	0.3070E 04	0.1391E 07	0.1794E 07	0.9631E 06	0.1248E 07	0.3317E 09
25.50	0.1050E 01	0.3070E 04	0.1448E 07	0.1868E 07	0.1001E 07	0.1297E 07	0.3450E 09
26.00	0.1055E 01	0.3070E 04	0.1506E 07	0.1943E 07	0.1041E 07	0.1348E 07	0.3587E 09
26.50	0.1031E 01	0.3069E 04	0.1565E 07	0.2019E 07	0.1080E 07	0.1407E 07	0.3726E 09
27.00	0.1007E 01	0.3069E 04	0.1626E 07	0.2097E 07	0.1121E 07	0.1452E 07	0.3868E 09
27.50	0.1042E 01	0.3069E 04	0.1688E 07	0.2176E 07	0.1163E 07	0.1506E 07	0.4013E 09
28.00	0.1077E 01	0.3068E 04	0.1750E 07	0.2257E 07	0.1205E 07	0.1561E 07	0.4160E 09
28.50	0.1077E 01	0.3068E 04	0.1814E 07	0.2339E 07	0.1248E 07	0.1616E 07	0.4310E 09
29.00	0.1077E 01	0.3068E 04	0.1879E 07	0.2423E 07	0.1291E 07	0.1673E 07	0.4462E 09
29.50	0.1067E 01	0.3068E 04	0.1945E 07	0.2508E 07	0.1336E 07	0.1731E 07	0.4617E 09
30.00	0.1058E 01	0.3067E 04	0.2013E 07	0.2595E 07	0.1381E 07	0.1789E 07	0.4775E 09
30.50	0.1044E 01	0.3067E 04	0.2081E 07	0.2683E 07	0.1427E 07	0.1849E 07	0.4935E 09
31.00	0.1030E 01	0.3067E 04	0.2151E 07	0.2772E 07	0.1474E 07	0.1909E 07	0.5099E 09
31.50	0.1061E 01	0.3066E 04	0.2221E 07	0.2863E 07	0.1521E 07	0.1971E 07	0.5264E 09
32.00	0.1092E 01	0.3066E 04	0.2293E 07	0.2956E 07	0.1570E 07	0.2033E 07	0.5433E 09
32.50	0.1046E 01	0.3066E 04	0.2366E 07	0.3050E 07	0.1619E 07	0.2097E 07	0.5604E 09
33.00	0.1000E 01	0.3065E 04	0.2440E 07	0.3145E 07	0.1669E 07	0.2161E 07	0.5777E 09
33.50	0.1037E 01	0.3065E 04	0.2515E 07	0.3242E 07	0.1719E 07	0.2227E 07	0.5954E 09
34.00	0.1073E 01	0.3065E 04	0.2591E 07	0.3340E 07	0.1771E 07	0.2293E 07	0.6133E 09

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 16.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.1002E 01	0.	0.3153E 04	0.5963E 04	0.5963E 04	0.7713E 04	0.1968E 07
1.04	0.1001E 01	0.	0.3272E 04	0.6178E 04	0.6178E 04	0.7992E 04	0.2039E 07
1.07	0.1001E 01	0.	0.3392E 04	0.6404E 04	0.6404E 04	0.8284E 04	0.2114E 07
1.10	0.1001E 01	0.	0.3511E 04	0.6640E 04	0.6640E 04	0.8590E 04	0.2192E 07
1.20	0.1001E 01	0.	0.3982E 04	0.7495E 04	0.7495E 04	0.9696E 04	0.2474E 07
1.30	0.1001E 01	0.	0.4533E 04	0.8448E 04	0.8448E 04	0.1093E 05	0.2789E 07
1.40	0.1001E 01	0.	0.5166E 04	0.9493E 04	0.9493E 04	0.1228E 05	0.3134E 07
1.50	0.1000E 01	0.5812E 04	0.5883E 04	0.1063E 05	0.1063E 05	0.1375E 05	0.3508E 07
1.60	0.1000E 01	0.5900E 04	0.6684E 04	0.1185E 05	0.1185E 05	0.1532E 05	0.3910E 07
1.70	0.1000E 01	0.5906E 04	0.7568E 04	0.1315E 05	0.1315E 05	0.1701E 05	0.4341E 07
1.80	0.1000E 01	0.5911E 04	0.8534E 04	0.1454E 05	0.1454E 05	0.1881E 05	0.4799E 07
1.90	0.1000E 01	0.5916E 04	0.9578E 04	0.1601E 05	0.1601E 05	0.2071E 05	0.5284E 07
2.00	0.1001E 01	0.5922E 04	0.1070E 05	0.1756E 05	0.1756E 05	0.2272E 05	0.5796E 07
2.20	0.1001E 01	0.5921E 04	0.1316E 05	0.2091E 05	0.2091E 05	0.2705E 05	0.6902E 07
2.40	0.1000E 01	0.5918E 04	0.1591E 05	0.2459E 05	0.2459E 05	0.3180E 05	0.8115E 07
2.60	0.1000E 01	0.5915E 04	0.1894E 05	0.2858E 05	0.2858E 05	0.3698E 05	0.9435E 07
2.80	0.1000E 01	0.5911E 04	0.2223E 05	0.3291E 05	0.3291E 05	0.4257E 05	0.1086E 08
3.00	0.1000E 01	0.5908E 04	0.2578E 05	0.3755E 05	0.3755E 05	0.4857E 05	0.1239E 08
3.20	0.1001E 01	0.5904E 04	0.2960E 05	0.4252E 05	0.4252E 05	0.5500E 05	0.1403E 08
3.40	0.1001E 01	0.5901E 04	0.3367E 05	0.4780E 05	0.4780E 05	0.6184E 05	0.1578E 08
3.60	0.1001E 01	0.5897E 04	0.3800E 05	0.5341E 05	0.5341E 05	0.6909E 05	0.1763E 08
3.80	0.1001E 01	0.5894E 04	0.4258E 05	0.5934E 05	0.5934E 05	0.7676E 05	0.1959E 08
4.00	0.1001E 01	0.5891E 04	0.4742E 05	0.6559E 05	0.6559E 05	0.8485E 05	0.2165E 08
4.20	0.1001E 01	0.5890E 04	0.5250E 05	0.7217E 05	0.7217E 05	0.9335E 05	0.2382E 08
4.40	0.1001E 01	0.5890E 04	0.5784E 05	0.7906E 05	0.7906E 05	0.1023E 06	0.2610E 08
4.60	0.1001E 01	0.5890E 04	0.6343E 05	0.8627E 05	0.8627E 05	0.1116E 06	0.2848E 08
4.80	0.1001E 01	0.5890E 04	0.6927E 05	0.9381E 05	0.9381E 05	0.1213E 06	0.3096E 08
5.00	0.1002E 01	0.5889E 04	0.7536E 05	0.1017E 06	0.1017E 06	0.1315E 06	0.3356E 08

DESIGN JET MACH NUMBER = 16.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1002E 01	0.5889E 04	0.7536E 05	0.1017E 06	0.1017E 06	0.1315E 06	0.3356E 08
5.50	0.1002E 01	0.5889E 04	0.9169E 05	0.1227E 06	0.1227E 06	0.1587E 06	0.4050E 08
6.00	0.1003E 01	0.5888E 04	0.1096E 06	0.1458E 06	0.1458E 06	0.1885E 06	0.4811E 08
6.50	0.1004E 01	0.5888E 04	0.1290E 06	0.1708E 06	0.1708E 06	0.2209E 06	0.5638E 08
7.00	0.1005E 01	0.5887E 04	0.1500E 06	0.1979E 06	0.1979E 06	0.2559E 06	0.6531E 08
7.50	0.1004E 01	0.5887E 04	0.1726E 06	0.2269E 06	0.2269E 06	0.2935E 06	0.7490E 08
8.00	0.1004E 01	0.5886E 04	0.1967E 06	0.2580E 06	0.2580E 06	0.3337E 06	0.8516E 08
8.50	0.1004E 01	0.5885E 04	0.2224E 06	0.2911E 06	0.2911E 06	0.3765E 06	0.9607E 08
9.00	0.1004E 01	0.5885E 04	0.2496E 06	0.3261E 06	0.3261E 06	0.4219E 06	0.1077E 09
9.50	0.1007E 01	0.5884E 04	0.2784E 06	0.3632E 06	0.3632E 06	0.4698E 06	0.1199E 09
10.00	0.1009E 01	0.5884E 04	0.3088E 06	0.4023E 06	0.4023E 06	0.5204E 06	0.1328E 09
10.50	0.1007E 01	0.5883E 04	0.3407E 06	0.4434E 06	0.4434E 06	0.5735E 06	0.1464E 09
11.00	0.1004E 01	0.5883E 04	0.3742E 06	0.4865E 06	0.4865E 06	0.6293E 06	0.1606E 09
11.50	0.1007E 01	0.5882E 04	0.4092E 06	0.5316E 06	0.5316E 06	0.6876E 06	0.1755E 09
12.00	0.1009E 01	0.5882E 04	0.4458E 06	0.5787E 06	0.5787E 06	0.7486E 06	0.1910E 09
12.50	0.1012E 01	0.5881E 04	0.4839E 06	0.6278E 06	0.6278E 06	0.8121E 06	0.2072E 09
13.00	0.1015E 01	0.5880E 04	0.6858E 06	0.8892E 06	0.5172E 06	0.6691E 06	0.2241E 09
13.50	0.1017E 01	0.5880E 04	0.7468E 06	0.9679E 06	0.5527E 06	0.7149E 06	0.2416E 09
14.00	0.1019E 01	0.5879E 04	0.8084E 06	0.1047E 07	0.5908E 06	0.7643E 06	0.2598E 09
14.50	0.1019E 01	0.5879E 04	0.8717E 06	0.1129E 07	0.6309E 06	0.8161E 06	0.2787E 09
15.00	0.1019E 01	0.5878E 04	0.9367E 06	0.1212E 07	0.6727E 06	0.8701E 06	0.2982E 09
15.50	0.1017E 01	0.5878E 04	0.1004E 07	0.1299E 07	0.7160E 06	0.9262E 06	0.3184E 09
16.00	0.1014E 01	0.5877E 04	0.1073E 07	0.1388E 07	0.7609E 06	0.9843E 06	0.3392E 09
16.50	0.1019E 01	0.5877E 04	0.1144E 07	0.1479E 07	0.8074E 06	0.1044E 07	0.3607E 09
17.00	0.1024E 01	0.5876E 04	0.1217E 07	0.1574E 07	0.8553E 06	0.1106E 07	0.3829E 09
17.50	0.1027E 01	0.5875E 04	0.1293E 07	0.1671E 07	0.9047E 06	0.1170E 07	0.4057E 09
18.00	0.1029E 01	0.5875E 04	0.1370E 07	0.1771E 07	0.9556E 06	0.1236E 07	0.4292E 09
18.50	0.1031E 01	0.5874E 04	0.1450E 07	0.1873E 07	0.1008E 07	0.1304E 07	0.4533E 09
19.00	0.1033E 01	0.5874E 04	0.1532E 07	0.1979E 07	0.1062E 07	0.1374E 07	0.4781E 09
19.50	0.1036E 01	0.5873E 04	0.1616E 07	0.2087E 07	0.1117E 07	0.1445E 07	0.5036E 09

DESIGN JET MACH NUMBER = 16.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.1036E 01	0.5873E 04	0.1616E 07	0.2087E 07	0.1117E 07	0.1445E 07	0.5036E 09
20.00	0.1039E 01	0.5873E 04	0.1702E 07	0.2198E 07	0.1174E 07	0.1518E 07	0.5297E 09
20.50	0.1035E 01	0.5872E 04	0.1790E 07	0.2312E 07	0.1232E 07	0.1594E 07	0.5565E 09
21.00	0.1031E 01	0.5871E 04	0.1881E 07	0.2428E 07	0.1292E 07	0.1671E 07	0.5840E 09
21.50	0.1017E 01	0.5871E 04	0.1973E 07	0.2547E 07	0.1353E 07	0.1750E 07	0.6121E 09
22.00	0.1004E 01	0.5870E 04	0.2068E 07	0.2669E 07	0.1415E 07	0.1831E 07	0.6409E 09
22.50	0.1025E 01	0.5870E 04	0.2165E 07	0.2794E 07	0.1479E 07	0.1914E 07	0.6703E 09
23.00	0.1045E 01	0.5869E 04	0.2264E 07	0.2922E 07	0.1545E 07	0.1998E 07	0.7004E 09
23.50	0.1031E 01	0.5869E 04	0.2365E 07	0.3052E 07	0.1612E 07	0.2085E 07	0.7312E 09
24.00	0.1016E 01	0.5868E 04	0.2469E 07	0.3185E 07	0.1680E 07	0.2173E 07	0.7626E 09
24.50	0.1013E 01	0.5868E 04	0.2575E 07	0.3322E 07	0.1750E 07	0.2263E 07	0.7947E 09
25.00	0.1010E 01	0.5867E 04	0.2682E 07	0.3460E 07	0.1821E 07	0.2356E 07	0.8275E 09
25.50	0.1019E 01	0.5866E 04	0.2792E 07	0.3602E 07	0.1894E 07	0.2450E 07	0.8609E 09
26.00	0.1028E 01	0.5866E 04	0.2905E 07	0.3746E 07	0.1968E 07	0.2546E 07	0.8949E 09
26.50	0.1040E 01	0.5865E 04	0.3019E 07	0.3894E 07	0.2043E 07	0.2643E 07	0.9297E 09
27.00	0.1053E 01	0.5865E 04	0.3135E 07	0.4044E 07	0.2120E 07	0.2743E 07	0.9651E 09
27.50	0.1053E 01	0.5864E 04	0.3254E 07	0.4196E 07	0.2199E 07	0.2844E 07	0.1001E 10
28.00	0.1054E 01	0.5864E 04	0.3375E 07	0.4352E 07	0.2279E 07	0.2948E 07	0.1038E 10
28.50	0.1051E 01	0.5863E 04	0.3498E 07	0.4510E 07	0.2360E 07	0.3053E 07	0.1075E 10
29.00	0.1049E 01	0.5863E 04	0.3623E 07	0.4672E 07	0.2443E 07	0.3160E 07	0.1113E 10
29.50	0.1068E 01	0.5862E 04	0.3750E 07	0.4836E 07	0.2527E 07	0.3269E 07	0.1152E 10
30.00	0.1087E 01	0.5861E 04	0.3880E 07	0.5002E 07	0.2613E 07	0.3380E 07	0.1191E 10
30.50	0.1093E 01	0.5861E 04	0.4012E 07	0.5172E 07	0.2700E 07	0.3492E 07	0.1231E 10
31.00	0.1075E 01	0.5860E 04	0.4146E 07	0.5344E 07	0.2788E 07	0.3607E 07	0.1272E 10
31.50	0.1066E 01	0.5860E 04	0.4282E 07	0.5520E 07	0.2878E 07	0.3723E 07	0.1313E 10
32.00	0.1057E 01	0.5859E 04	0.4420E 07	0.5698E 07	0.2970E 07	0.3842E 07	0.1355E 10
32.50	0.1067E 01	0.5859E 04	0.4560E 07	0.5878E 07	0.3063E 07	0.3962E 07	0.1398E 10
33.00	0.1078E 01	0.5858E 04	0.4703E 07	0.6062E 07	0.3157E 07	0.4084E 07	0.1441E 10
33.50	0.1094E 01	0.5857E 04	0.4848E 07	0.6248E 07	0.3253E 07	0.4208E 07	0.1485E 10
34.00	0.1111E 01	0.5857E 04	0.4995E 07	0.6438E 07	0.3350E 07	0.4333E 07	0.1530E 10

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 18.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.1001E 01	0.	0.5604E 04	0.1060E 05	0.1060E 05	0.1370E 05	0.4426E 07
1.04	0.1000E 01	0.	0.5816E 04	0.1098E 05	0.1098E 05	0.1419E 05	0.4586E 07
1.07	0.1001E 01	0.	0.6028E 04	0.1138E 05	0.1138E 05	0.1471E 05	0.4754E 07
1.10	0.1000E 01	0.	0.6241E 04	0.1180E 05	0.1180E 05	0.1525E 05	0.4929E 07
1.20	0.1000E 01	0.	0.7078E 04	0.1332E 05	0.1332E 05	0.1722E 05	0.5564E 07
1.30	0.1000E 01	0.	0.8056E 04	0.1502E 05	0.1502E 05	0.1940E 05	0.6271E 07
1.40	0.1000E 01	0.	0.9181E 04	0.1687E 05	0.1687E 05	0.2180E 05	0.7047E 07
1.50	0.1000E 01	0.1033E 05	0.1046E 05	0.1889E 05	0.1889E 05	0.2441E 05	0.7888E 07
1.60	0.1000E 01	0.1049E 05	0.1188E 05	0.2105E 05	0.2105E 05	0.2721E 05	0.8793E 07
1.70	0.1000E 01	0.1050E 05	0.1345E 05	0.2337E 05	0.2337E 05	0.3020E 05	0.9761E 07
1.80	0.1000E 01	0.1051E 05	0.1517E 05	0.2584E 05	0.2584E 05	0.3339E 05	0.1079E 08
1.90	0.1000E 01	0.1052E 05	0.1702E 05	0.2845E 05	0.2845E 05	0.3677E 05	0.1188E 08
2.00	0.1000E 01	0.1052E 05	0.1902E 05	0.3121E 05	0.3121E 05	0.4033E 05	0.1303E 08
2.20	0.1000E 01	0.1052E 05	0.2340E 05	0.3717E 05	0.3717E 05	0.4803E 05	0.1552E 08
2.40	0.1000E 01	0.1052E 05	0.2828E 05	0.4370E 05	0.4370E 05	0.5647E 05	0.1825E 08
2.60	0.1000E 01	0.1051E 05	0.3366E 05	0.5080E 05	0.5080E 05	0.6565E 05	0.2122E 08
2.80	0.1001E 01	0.1051E 05	0.3951E 05	0.5849E 05	0.5849E 05	0.7558E 05	0.2443E 08
3.00	0.1000E 01	0.1050E 05	0.4583E 05	0.6674E 05	0.6674E 05	0.8625E 05	0.2787E 08
3.20	0.1001E 01	0.1049E 05	0.5261E 05	0.7556E 05	0.7556E 05	0.9765E 05	0.3156E 08
3.40	0.1001E 01	0.1049E 05	0.5985E 05	0.8496E 05	0.8496E 05	0.1098E 06	0.3548E 08
3.60	0.1001E 01	0.1048E 05	0.6754E 05	0.9493E 05	0.9493E 05	0.1227E 06	0.3965E 08
3.80	0.1001E 01	0.1048E 05	0.7568E 05	0.1055E 06	0.1055E 06	0.1363E 06	0.4405E 08
4.00	0.1001E 01	0.1047E 05	0.8427E 05	0.1166E 06	0.1166E 06	0.1507E 06	0.4869E 08
4.20	0.1002E 01	0.1047E 05	0.9332E 05	0.1283E 06	0.1283E 06	0.1658E 06	0.5357E 08
4.40	0.1001E 01	0.1047E 05	0.1028E 06	0.1405E 06	0.1405E 06	0.1816E 06	0.5868E 08
4.60	0.1001E 01	0.1047E 05	0.1127E 06	0.1533E 06	0.1533E 06	0.1982E 06	0.6404E 08
4.80	0.1002E 01	0.1047E 05	0.1231E 06	0.1667E 06	0.1667E 06	0.2155E 06	0.6963E 08
5.00	0.1002E 01	0.1047E 05	0.1339E 06	0.1807E 06	0.1807E 06	0.2335E 06	0.7546E 08

DESIGN JET MACH NUMBER = 18.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1002E 01	0.1047E 05	0.1339E 06	0.1807E 06	0.1807E 06	0.2335E 06	0.7546E 08
5.50	0.1002E 01	0.1047E 05	0.1630E 06	0.2181E 06	0.2181E 06	0.2818E 06	0.9108E 08
6.00	0.1003E 01	0.1047E 05	0.1947E 06	0.2591E 06	0.2591E 06	0.3348E 06	0.1082E 09
6.50	0.1004E 01	0.1046E 05	0.2293E 06	0.3036E 06	0.3036E 06	0.3923E 06	0.1268E 09
7.00	0.1005E 01	0.1046E 05	0.2666E 06	0.3517E 06	0.3517E 06	0.4545E 06	0.1469E 09
7.50	0.1004E 01	0.1046E 05	0.3067E 06	0.4033E 06	0.4033E 06	0.5212E 06	0.1684E 09
8.00	0.1004E 01	0.1046E 05	0.3496E 06	0.4585E 06	0.4585E 06	0.5926E 06	0.1915E 09
8.50	0.1004E 01	0.1046E 05	0.3953E 06	0.5173E 06	0.5173E 06	0.6685E 06	0.2160E 09
9.00	0.1004E 01	0.1046E 05	0.4437E 06	0.5797E 06	0.5797E 06	0.7491E 06	0.2421E 09
9.50	0.1007E 01	0.1046E 05	0.4948E 06	0.6456E 06	0.6456E 06	0.8342E 06	0.2696E 09
10.00	0.1009E 01	0.1046E 05	0.5488E 06	0.7150E 06	0.7150E 06	0.9240E 06	0.2986E 09
10.50	0.1007E 01	0.1046E 05	0.6055E 06	0.7880E 06	0.7880E 06	0.1018E 07	0.3291E 09
11.00	0.1004E 01	0.1046E 05	0.6650E 06	0.8646E 06	0.8646E 06	0.1117E 07	0.3611E 09
11.50	0.1007E 01	0.1045E 05	0.7272E 06	0.9448E 06	0.9448E 06	0.1221E 07	0.3946E 09
12.00	0.1009E 01	0.1045E 05	0.1028E 07	0.1335E 07	0.7892E 06	0.1020E 07	0.4295E 09
12.50	0.1012E 01	0.1045E 05	0.1134E 07	0.1472E 07	0.8430E 06	0.1089E 07	0.4660E 09
13.00	0.1015E 01	0.1045E 05	0.1237E 07	0.1604E 07	0.9048E 06	0.1169E 07	0.5039E 09
13.50	0.1017E 01	0.1045E 05	0.1342E 07	0.1740E 07	0.9703E 06	0.1254E 07	0.5433E 09
14.00	0.1019E 01	0.1045E 05	0.1451E 07	0.1880E 07	0.1039E 07	0.1343E 07	0.5843E 09
14.50	0.1019E 01	0.1045E 05	0.1563E 07	0.2024E 07	0.1117E 07	0.1435E 07	0.6267E 09
15.00	0.1019E 01	0.1045E 05	0.1679E 07	0.2173E 07	0.1185E 07	0.1531E 07	0.6705E 09
15.50	0.1017E 01	0.1045E 05	0.1798E 07	0.2327E 07	0.1262E 07	0.1630E 07	0.7159E 09
16.00	0.1014E 01	0.1045E 05	0.1921E 07	0.2485E 07	0.1341E 07	0.1733E 07	0.7628E 09
16.50	0.1019E 01	0.1044E 05	0.2048E 07	0.2649E 07	0.1423E 07	0.1839E 07	0.8111E 09
17.00	0.1024E 01	0.1044E 05	0.2179E 07	0.2817E 07	0.1508E 07	0.1949E 07	0.8610E 09
17.50	0.1027E 01	0.1044E 05	0.2313E 07	0.2990E 07	0.1596E 07	0.2062E 07	0.9123E 09
18.00	0.1029E 01	0.1044E 05	0.2452E 07	0.3160E 07	0.1686E 07	0.2178E 07	0.9651E 09
18.50	0.1031E 01	0.1044E 05	0.2594E 07	0.3352E 07	0.1778E 07	0.2298E 07	0.1019E 10
19.00	0.1033E 01	0.1044E 05	0.2740E 07	0.3540E 07	0.1873E 07	0.2421E 07	0.1075E 10
19.50	0.1036E 01	0.1044E 05	0.2890E 07	0.3733E 07	0.1971E 07	0.2547E 07	0.1132E 10

DESIGN JET MACH NUMBER = 18.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.1036E 01	0.1044E 05	0.2890E 07	0.3733E 07	0.1971E 07	0.2547E 07	0.1132E 10
20.00	0.1039E 01	0.1044E 05	0.3044E 07	0.3931E 07	0.2071E 07	0.2677E 07	0.1191E 10
20.50	0.1035E 01	0.1044E 05	0.3201E 07	0.4134E 07	0.2174E 07	0.2810E 07	0.1252E 10
21.00	0.1031E 01	0.1044E 05	0.3363E 07	0.4342E 07	0.2280E 07	0.2946E 07	0.1313E 10
21.50	0.1019E 01	0.1043E 05	0.3528E 07	0.4555E 07	0.2388E 07	0.3085E 07	0.1376E 10
22.00	0.1006E 01	0.1043E 05	0.3698E 07	0.4773E 07	0.2498E 07	0.3228E 07	0.1441E 10
22.50	0.1026E 01	0.1043E 05	0.3871E 07	0.4996E 07	0.2611E 07	0.3374E 07	0.1507E 10
23.00	0.1046E 01	0.1043E 05	0.4048E 07	0.5224E 07	0.2727E 07	0.3524E 07	0.1575E 10
23.50	0.1031E 01	0.1043E 05	0.4229E 07	0.5457E 07	0.2845E 07	0.3677E 07	0.1644E 10
24.00	0.1017E 01	0.1043E 05	0.4414E 07	0.5695E 07	0.2966E 07	0.3833E 07	0.1715E 10
24.50	0.1015E 01	0.1043E 05	0.4602E 07	0.5938E 07	0.3089E 07	0.3992E 07	0.1787E 10
25.00	0.1012E 01	0.1043E 05	0.4795E 07	0.6186E 07	0.3215E 07	0.4155E 07	0.1861E 10
25.50	0.1020E 01	0.1043E 05	0.4991E 07	0.6439E 07	0.3343E 07	0.4321E 07	0.1936E 10
26.00	0.1028E 01	0.1043E 05	0.5192E 07	0.6697E 07	0.3474E 07	0.4490E 07	0.2012E 10
26.50	0.1041E 01	0.1042E 05	0.5396E 07	0.6960E 07	0.3608E 07	0.4662E 07	0.2091E 10
27.00	0.1053E 01	0.1042E 05	0.5604E 07	0.7227E 07	0.3744E 07	0.4838E 07	0.2170E 10
27.50	0.1053E 01	0.1042E 05	0.5816E 07	0.7500E 07	0.3882E 07	0.5017E 07	0.2251E 10
28.00	0.1054E 01	0.1042E 05	0.6032E 07	0.7778E 07	0.4024E 07	0.5200E 07	0.2334E 10
28.50	0.1051E 01	0.1042E 05	0.6252E 07	0.8061E 07	0.4167E 07	0.5385E 07	0.2418E 10
29.00	0.1049E 01	0.1042E 05	0.6475E 07	0.8349E 07	0.4314E 07	0.5574E 07	0.2503E 10
29.50	0.1068E 01	0.1042E 05	0.6703E 07	0.8642E 07	0.4462E 07	0.5767E 07	0.2590E 10
30.00	0.1087E 01	0.1042E 05	0.6934E 07	0.8940E 07	0.4614E 07	0.5962E 07	0.2679E 10
30.50	0.1081E 01	0.1042E 05	0.7170E 07	0.9243E 07	0.4768E 07	0.6161E 07	0.2769E 10
31.00	0.1075E 01	0.1042E 05	0.7409E 07	0.9551E 07	0.4924E 07	0.6363E 07	0.2861E 10
31.50	0.1066E 01	0.1041E 05	0.7652E 07	0.9864E 07	0.5083E 07	0.6569E 07	0.2953E 10
32.00	0.1057E 01	0.1041E 05	0.7899E 07	0.1018E 08	0.5244E 07	0.6777E 07	0.3048E 10
32.50	0.1067E 01	0.1041E 05	0.8150E 07	0.1051E 08	0.5409E 07	0.6989E 07	0.3144E 10
33.00	0.1078E 01	0.1041E 05	0.8405E 07	0.1083E 08	0.5575E 07	0.7205E 07	0.3241E 10
33.50	0.1095E 01	0.1041E 05	0.8663E 07	0.1117E 08	0.5744E 07	0.7423E 07	0.3340E 10
34.00	0.1111E 01	0.1041E 05	0.8926E 07	0.1150E 08	0.5916E 07	0.7645E 07	0.3441E 10

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 20.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.1001E 01	0.	0.9397E 04	0.1777E 05	0.1777E 05	0.2295E 05	0.9160E 07
1.04	0.1000E 01	0.	0.9753E 04	0.1841E 05	0.1841E 05	0.2378E 05	0.9491E 07
1.07	0.1001E 01	0.	0.1011E 05	0.1909E 05	0.1909E 05	0.2465E 05	0.9839E 07
1.10	0.1000E 01	0.	0.1046E 05	0.1979E 05	0.1979E 05	0.2556E 05	0.1020E 08
1.20	0.1000E 01	0.	0.1187E 05	0.2234E 05	0.2234E 05	0.2885E 05	0.1152E 08
1.30	0.1000E 01	0.	0.1351E 05	0.2518E 05	0.2518E 05	0.3252E 05	0.1298E 08
1.40	0.1000E 01	0.	0.1540E 05	0.2829E 05	0.2829E 05	0.3654E 05	0.1458E 08
1.50	0.1000E 01	0.1732E 05	0.1753E 05	0.3167E 05	0.3167E 05	0.4090E 05	0.1633E 08
1.60	0.1000E 01	0.1758E 05	0.1992E 05	0.3530E 05	0.3530E 05	0.4559E 05	0.1820E 08
1.70	0.1000E 01	0.1760E 05	0.2256E 05	0.3919E 05	0.3919E 05	0.5061E 05	0.2020E 08
1.80	0.1000E 01	0.1762E 05	0.2543E 05	0.4333E 05	0.4333E 05	0.5595E 05	0.2233E 08
1.90	0.1000E 01	0.1763E 05	0.2854E 05	0.4771E 05	0.4771E 05	0.6161E 05	0.2459E 08
2.00	0.1000E 01	0.1765E 05	0.3189E 05	0.5234E 05	0.5234E 05	0.6759E 05	0.2698E 08
2.20	0.1000E 01	0.1765E 05	0.3923E 05	0.6232E 05	0.6232E 05	0.8048E 05	0.3212E 08
2.40	0.1001E 01	0.1764E 05	0.4742E 05	0.7327E 05	0.7327E 05	0.9462E 05	0.3777E 08
2.60	0.1000E 01	0.1763E 05	0.5643E 05	0.8519E 05	0.8519E 05	0.1100E 06	0.4391E 08
2.80	0.1001E 01	0.1762E 05	0.6625E 05	0.9807E 05	0.9807E 05	0.1266E 06	0.5055E 08
3.00	0.1001E 01	0.1761E 05	0.7684E 05	0.1119E 06	0.1119E 06	0.1445E 06	0.5769E 08
3.20	0.1001E 01	0.1760E 05	0.8821E 05	0.1267E 06	0.1267E 06	0.1636E 06	0.6532E 08
3.40	0.1001E 01	0.1759E 05	0.1003E 06	0.1425E 06	0.1425E 06	0.1840E 06	0.7344E 08
3.60	0.1001E 01	0.1758E 05	0.1132E 06	0.1592E 06	0.1592E 06	0.2056E 06	0.8205E 08
3.80	0.1001E 01	0.1757E 05	0.1269E 06	0.1769E 06	0.1769E 06	0.2284E 06	0.9116E 08
4.00	0.1001E 01	0.1756E 05	0.1413E 06	0.1955E 06	0.1955E 06	0.2524E 06	0.1008E 09
4.20	0.1001E 01	0.1755E 05	0.1565E 06	0.2151E 06	0.2151E 06	0.2777E 06	0.1109E 09
4.40	0.1002E 01	0.1755E 05	0.1724E 06	0.2356E 06	0.2356E 06	0.3043E 06	0.1215E 09
4.60	0.1002E 01	0.1755E 05	0.1890E 06	0.2571E 06	0.2571E 06	0.3320E 06	0.1325E 09
4.80	0.1001E 01	0.1755E 05	0.2064E 06	0.2796E 06	0.2796E 06	0.3610E 06	0.1441E 09
5.00	0.1003E 01	0.1755E 05	0.2246E 06	0.3030E 06	0.3030E 06	0.3913E 06	0.1562E 09

DESIGN JET MACH NUMBER = 20.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1003E 01	0.1755E 05	0.2246E 06	0.3030E 06	0.3030E 06	0.3913E 06	0.1562E 09
5.50	0.1002E 01	0.1755E 05	0.2732E 06	0.3657E 06	0.3657E 06	0.4723E 06	0.1885E 09
6.00	0.1002E 01	0.1755E 05	0.3266E 06	0.4344E 06	0.4344E 06	0.5610E 06	0.2239E 09
6.50	0.1003E 01	0.1755E 05	0.3845E 06	0.5090E 06	0.5090E 06	0.6574E 06	0.2624E 09
7.00	0.1003E 01	0.1755E 05	0.4471E 06	0.5897E 06	0.5897E 06	0.7615E 06	[illegible] 09
7.50	0.1005E 01	0.1754E 05	0.5144E 06	0.6763E 06	0.6763E 06	0.8734E 06	0.3486E 09
8.00	0.1006E 01	0.1754E 05	0.5862E 06	0.7689E 06	0.7689E 06	0.9929E 06	0.3963E 09
8.50	0.1007E 01	0.1754E 05	0.6628E 06	0.8674E 06	0.8674E 06	0.1120E 07	0.4471E 09
9.00	0.1007E 01	0.1754E 05	0.7439E 06	0.9720E 06	0.9720E 06	0.1255E 07	0.5010E 09
9.50	0.1007E 01	0.1754E 05	0.8298E 06	0.1082E 07	0.1082E 07	0.1398E 07	0.5580E 09
10.00	0.1006E 01	0.1754E 05	0.9202E 06	0.1199E 07	0.1199E 07	0.1548E 07	0.6180E 09
10.50	0.1008E 01	0.1753E 05	0.1015E 07	0.1321E 07	0.1321E 07	0.1706E 07	0.6812E 09
11.00	0.1010E 01	0.1753E 05	0.1115E 07	0.1450E 07	0.1450E 07	0.1872E 07	0.7474E 09
11.50	0.1012E 01	0.1753E 05	0.1578E 07	0.2050E 07	0.1217E 07	0.1572E 07	0.8166E 09
12.00	0.1014E 01	0.1753E 05	0.1752E 07	0.2275E 07	0.1301E 07	0.1680E 07	0.8890E 09
12.50	0.1011E 01	0.1753E 05	0.1919E 07	0.2490E 07	0.1400E 07	0.1808E 07	0.9644E 09
13.00	0.1009E 01	0.1753E 05	0.2090E 07	0.2709E 07	0.1505E 07	0.1944E 07	0.1043E 10
13.50	0.1011E 01	0.1752E 05	0.2265E 07	0.2936E 07	0.1616E 07	0.2086E 07	0.1125E 10
14.00	0.1014E 01	0.1752E 05	0.2447E 07	0.3170E 07	0.1731E 07	0.2235E 07	0.1209E 10
14.50	0.1013E 01	0.1752E 05	0.2635E 07	0.3412E 07	0.1850E 07	0.2390E 07	0.1297E 10
15.00	0.1012E 01	0.1752E 05	0.2830E 07	0.3663E 07	0.1975E 07	0.2550E 07	0.1388E 10
15.50	0.1018E 01	0.1752E 05	0.3030E 07	0.3921E 07	0.2103E 07	0.2716E 07	0.1482E 10
16.00	0.1023E 01	0.1752E 05	0.3237E 07	0.4187E 07	0.2236E 07	0.2888E 07	0.1579E 10
16.50	0.1019E 01	0.1751E 05	0.3450E 07	0.4462E 07	0.2374E 07	0.3066E 07	0.1679E 10
17.00	0.1014E 01	0.1751E 05	0.3670E 07	0.4745E 07	0.2516E 07	0.3249E 07	0.1782E 10
17.50	0.1016E 01	0.1751E 05	0.3897E 07	0.5037E 07	0.2662E 07	0.3437E 07	0.1888E 10
18.00	0.1018E 01	0.1751E 05	0.4129E 07	0.5336E 07	0.2812E 07	0.3631E 07	0.1998E 10
18.50	0.1020E 01	0.1751E 05	0.4369E 07	0.5644E 07	0.2967E 07	0.3831E 07	0.2110E 10
19.00	0.1021E 01	0.1750E 05	0.4614E 07	0.5961E 07	0.3126E 07	0.4036E 07	0.2225E 10
19.50	0.1024E 01	0.1750E 05	0.4867E 07	0.6286E 07	0.3289E 07	0.4247E 07	0.2344E 10

DESIGN JET MACH NUMBER = 20.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.1024E 01	0.1750E 05	0.4867E 07	0.6286E 07	0.3289E 07	0.4247E 07	0.2344E 10
20.00	0.1028E 01	0.1750E 05	0.5125E 07	0.6619E 07	0.3456E 07	0.4464E 07	0.2466E 10
20.50	0.1036E 01	0.1750E 05	0.5391E 07	0.6960E 07	0.3628E 07	0.4685E 07	0.2590E 10
21.00	0.1044E 01	0.1750E 05	0.5662E 07	0.7310E 07	0.3804E 07	0.4913E 07	0.2718E 10
21.50	0.1040E 01	0.1750E 05	0.5941E 07	0.7669E 07	0.3985E 07	0.5146E 07	0.2849E 10
22.00	0.1036E 01	0.1749E 05	0.6226E 07	0.8035E 07	0.4169E 07	0.5384E 07	0.2983E 10
22.50	0.1031E 01	0.1749E 05	0.6517E 07	0.8411E 07	0.4358E 07	0.5628E 07	0.3120E 10
23.00	0.1026E 01	0.1749E 05	0.6815E 07	0.8794E 07	0.4551E 07	0.5877E 07	0.3260E 10
23.50	0.1036E 01	0.1749E 05	0.7119E 07	0.9186E 07	0.4748E 07	0.6132E 07	0.3403E 10
24.00	0.1045E 01	0.1749E 05	0.7430E 07	0.9587E 07	0.4950E 07	0.6393E 07	0.3549E 10
24.50	0.1046E 01	0.1749E 05	0.7748E 07	0.9995E 07	0.5156E 07	0.6658E 07	0.3699E 10
25.00	0.1047E 01	0.1748E 05	0.8072E 07	0.1041E 08	0.5366E 07	0.6930E 07	0.3851E 10
25.50	0.1052E 01	0.1748E 05	0.8402E 07	0.1084E 08	0.5581E 07	0.7207E 07	0.4007E 10
26.00	0.1057E 01	0.1748E 05	0.8739E 07	0.1127E 08	0.5799E 07	0.7489E 07	0.4165E 10
26.50	0.1036E 01	0.1748E 05	0.9083E 07	0.1171E 08	0.6022E 07	0.7777E 07	0.4327E 10
27.00	0.1015E 01	0.1748E 05	0.9433E 07	0.1217E 08	0.6249E 07	0.8070E 07	0.4492E 10
27.50	0.1047E 01	0.1748E 05	0.9790E 07	0.1263E 08	0.6481E 07	0.8369E 07	0.4659E 10
28.00	0.1078E 01	0.1747E 05	0.1015E 08	0.1309E 08	0.6716E 07	0.8674E 07	0.4830E 10
28.50	0.1078E 01	0.1747E 05	0.1052E 08	0.1357E 08	0.6956E 07	0.8983E 07	0.5004E 10
29.00	0.1078E 01	0.1747E 05	0.1090E 08	0.1405E 08	0.7201E 07	0.9299E 07	0.5181E 10
29.50	0.1069E 01	0.1747E 05	0.1128E 08	0.1455E 08	0.7449E 07	0.9620E 07	0.5362E 10
30.00	0.1060E 01	0.1747E 05	0.1167E 08	0.1505E 08	0.7702E 07	0.9946E 07	0.5545E 10
30.50	0.1047E 01	0.1747E 05	0.1207E 08	0.1556E 08	0.7959E 07	0.1028E 08	0.5731E 10
31.00	0.1033E 01	0.1746E 05	0.1247E 08	0.1608E 08	0.8220E 07	0.1062E 08	0.5920E 10
31.50	0.1063E 01	0.1746E 05	0.1288E 08	0.1660E 08	0.8485E 07	0.1096E 08	0.6113E 10
32.00	0.1093E 01	0.1746E 05	0.1329E 08	0.1714E 08	0.8755E 07	0.1131E 08	0.6308E 10
32.50	0.1055E 01	0.1746E 05	0.1372E 08	0.1768E 08	0.9029E 07	0.1166E 08	0.6507E 10
33.00	0.1017E 01	0.1746E 05	0.1415E 08	0.1823E 08	0.9307E 07	0.1202E 08	0.6709E 10
33.50	0.1046E 01	0.1746E 05	0.1458E 08	0.1879E 08	0.9590E 07	0.1238E 08	0.6913E 10
34.00	0.1076E 01	0.1745E 05	0.1502E 08	0.1936E 08	0.9876E 07	0.1275E 08	0.7121E 10

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 22.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.1001E 01	0.	0.1502E 05	0.2841E 05	0.2841E 05	0.3667E 05	0.1772E 08
1.04	0.1000E 01	0.	0.1559E 05	0.2944E 05	0.2944E 05	0.3799E 05	0.1836E 08
1.07	0.1001E 01	0.	0.1616E 05	0.3051E 05	0.3051E 05	0.3938E 05	0.1903E 08
1.10	0.1000E 01	0.	0.1673E 05	0.3164E 05	0.3164E 05	0.4084E 05	0.1973E 08
1.20	0.1000E 01	0.	0.1897E 05	0.3571E 05	0.3571E 05	0.4609E 05	0.2227E 08
1.30	0.1000E 01	0.	0.2160E 05	0.4025E 05	0.4025E 05	0.5196E 05	0.2510E 08
1.40	0.1000E 01	0.	0.2461E 05	0.4523E 05	0.4523E 05	0.5838E 05	0.2821E 08
1.50	0.1000E 01	0.2769E 05	0.2803E 05	0.5063E 05	0.5063E 05	0.6535E 05	0.3158E 08
1.60	0.1000E 01	0.2811E 05	0.3185E 05	0.5644E 05	0.5644E 05	0.7285E 05	0.3520E 08
1.70	0.1000E 01	0.2814E 05	0.3606E 05	0.6266E 05	0.6266E 05	0.8087E 05	0.3907E 08
1.80	0.1000E 01	0.2816E 05	0.4066E 05	0.6927E 05	0.6927E 05	0.8940E 05	0.4320E 08
1.90	0.1000E 01	0.2819E 05	0.4563E 05	0.7627E 05	0.7627E 05	0.9845E 05	0.4757E 08
2.00	0.1000E 01	0.2821E 05	0.5098E 05	0.8367E 05	0.8367E 05	0.1080E 06	0.5218E 08
2.20	0.1000E 01	0.2821E 05	0.6272E 05	0.9963E 05	0.9963E 05	0.1286E 06	0.6213E 08
2.40	0.1001E 01	0.2820E 05	0.7581E 05	0.1171E 06	0.1171E 06	0.1512E 06	0.7305E 08
2.60	0.1001E 01	0.2818E 05	0.9022E 05	0.1362E 06	0.1362E 06	0.1758E 06	0.8494E 08
2.80	0.1001E 01	0.2816E 05	0.1059E 06	0.1568E 06	0.1568E 06	0.2024E 06	0.9778E 08
3.00	0.1001E 01	0.2815E 05	0.1228E 06	0.1789E 06	0.1789E 06	0.2309E 06	0.1116E 09
3.20	0.1001E 01	0.2813E 05	0.1410E 06	0.2026E 06	0.2026E 06	0.2615E 06	0.1263E 09
3.40	0.1001E 01	0.2811E 05	0.1604E 06	0.2278E 06	0.2278E 06	0.2940E 06	0.1420E 09
3.60	0.1001E 01	0.2810E 05	0.1810E 06	0.2545E 06	0.2545E 06	0.3285E 06	0.1587E 09
3.80	0.1001E 01	0.2808E 05	0.2029E 06	0.2827E 06	0.2827E 06	0.3649E 06	0.1763E 09
4.00	0.1001E 01	0.2807E 05	0.2259E 06	0.3125E 06	0.3125E 06	0.4034E 06	0.1949E 09
4.20	0.1002E 01	0.2806E 05	0.2502E 06	0.3438E 06	0.3438E 06	0.4438E 06	0.2144E 09
4.40	0.1001E 01	0.2806E 05	0.2756E 06	0.3767E 06	0.3767E 06	0.4862E 06	0.2349E 09
4.60	0.1001E 01	0.2806E 05	0.3022E 06	0.4110E 06	0.4110E 06	0.5305E 06	0.2563E 09
4.80	0.1002E 01	0.2806E 05	0.3301E 06	0.4469E 06	0.4469E 06	0.5769E 06	0.2787E 09
5.00	0.1002E 01	0.2806E 05	0.3591E 06	0.4844E 06	0.4844E 06	0.6252E 06	0.3021E 09

DESIGN JET MACH NUMBER = 22.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1002E 01	0.2806E 05	0.3591E 06	0.4844E 06	0.4844E 06	0.6252E 06	0.3021E 09
5.50	0.1003E 01	0.2806E 05	0.4368E 06	0.5846E 06	0.5846E 06	0.7546E 06	0.3646E 09
6.00	0.1003E 01	0.2805E 05	0.5221E 06	0.6944E 06	0.6944E 06	0.8963E 06	0.4331E 09
6.50	0.1004E 01	0.2805E 05	0.6147E 06	0.8138E 06	0.8138E 06	0.1050E 07	0.5075E 09
7.00	0.1005E 01	0.2805E 05	0.7148E 06	0.9427E 06	0.9427E 06	0.1217E 07	0.5879E 09
7.50	0.1004E 01	0.2805E 05	0.8223E 06	0.1081E 07	0.1081E 07	0.1396E 07	0.6743E 09
8.00	0.1004E 01	0.2804E 05	0.9372E 06	0.1229E 07	0.1229E 07	0.1587E 07	0.7666E 09
8.50	0.1004E 01	0.2804E 05	0.1060E 07	0.1387E 07	0.1387E 07	0.1790E 07	0.8648E 09
9.00	0.1005E 01	0.2804E 05	0.1189E 07	0.1554E 07	0.1554E 07	0.2006E 07	0.9691E 09
9.50	0.1007E 01	0.2804E 05	0.1327E 07	0.1731E 07	0.1731E 07	0.2234E 07	0.1079E 10
10.00	0.1009E 01	0.2803E 05	0.1471E 07	0.1917E 07	0.1917E 07	0.2474E 07	0.1195E 10
10.50	0.1007E 01	0.2803E 05	0.1623E 07	0.2113E 07	0.2113E 07	0.2727E 07	0.1317E 10
11.00	0.1005E 01	0.2803E 05	0.1783E 07	0.2318E 07	0.2318E 07	0.2992E 07	0.1446E 10
11.50	0.1007E 01	0.2803E 05	0.2562E 07	0.3328E 07	0.1916E 07	0.2473E 07	0.1580E 10
12.00	0.1009E 01	0.2802E 05	0.2820E 07	0.3661E 07	0.2065E 07	0.2666E 07	0.1719E 10
12.50	0.1012E 01	0.2802E 05	0.3084E 07	0.4001E 07	0.2225E 07	0.2872E 07	0.1865E 10
13.00	0.1015E 01	0.2802E 05	0.3356E 07	0.4351E 07	0.2394E 07	0.3090E 07	0.2017E 10
13.50	0.1017E 01	0.2801E 05	0.3637E 07	0.4714E 07	0.2571E 07	0.3318E 07	0.2175E 10
14.00	0.1019E 01	0.2801E 05	0.3928E 07	0.5088E 07	0.2755E 07	0.3555E 07	0.2339E 10
14.50	0.1020E 01	0.2801E 05	0.4229E 07	0.5476E 07	0.2946E 07	0.3802E 07	0.2509E 10
15.00	0.1020E 01	0.2801E 05	0.4540E 07	0.5876E 07	0.3144E 07	0.4058E 07	0.2684E 10
15.50	0.1017E 01	0.2800E 05	0.4861E 07	0.6290E 07	0.3349E 07	0.4323E 07	0.2866E 10
16.00	0.1014E 01	0.2800E 05	0.5193E 07	0.6717E 07	0.3561E 07	0.4597E 07	0.3054E 10
16.50	0.1020E 01	0.2800E 05	0.5534E 07	0.7157E 07	0.3781E 07	0.4880E 07	0.3247E 10
17.00	0.1025E 01	0.2800E 05	0.5887E 07	0.7611E 07	0.4007E 07	0.5171E 07	0.3447E 10
17.50	0.1027E 01	0.2799E 05	0.6249E 07	0.8077E 07	0.4239E 07	0.5472E 07	0.3652E 10
18.00	0.1029E 01	0.2799E 05	0.6622E 07	0.8558E 07	0.4479E 07	0.5781E 07	0.3863E 10
18.50	0.1031E 01	0.2799E 05	0.7005E 07	0.9051E 07	0.4726E 07	0.6100E 07	0.4081E 10
19.00	0.1033E 01	0.2799E 05	0.7399E 07	0.9558E 07	0.4979E 07	0.6427E 07	0.4304E 10
19.50	0.1036E 01	0.2798E 05	0.7804E 07	0.1008E 08	0.5239E 07	0.6763E 07	0.4533E 10

DESIGN JET MACH NUMBER = 22.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.1036E 01	0.2798E 05	0.7804E 07	0.1008E 08	0.5239E 07	0.6763E 07	0.4533E 10
20.00	0.1039E 01	0.2798E 05	0.8218E 07	0.1061E 08	0.5506E 07	0.7107E 07	0.4769E 10
20.50	0.1035E 01	0.2798E 05	0.8643E 07	0.1116E 08	0.5780E 07	0.7461E 07	0.5010E 10
21.00	0.1031E 01	0.2797E 05	0.9079E 07	0.1172E 08	0.6061E 07	0.7823E 07	0.5257E 10
21.50	0.1020E 01	0.2797E 05	0.9525E 07	0.1230E 08	0.6348E 07	0.8194E 07	0.5510E 10
22.00	0.1009E 01	0.2797E 05	0.9982E 07	0.1288E 08	0.6643E 07	0.8574E 07	0.5769E 10
22.50	0.1027E 01	0.2797E 05	0.1045E 08	0.1348E 08	0.6944E 07	0.8962E 07	0.6034E 10
23.00	0.1046E 01	0.2796E 05	0.1093E 08	0.1410E 08	0.7251E 07	0.9360E 07	0.6305E 10
23.50	0.1032E 01	0.2796E 05	0.1141E 08	0.1473E 08	0.7566E 07	0.9766E 07	0.6582E 10
24.00	0.1018E 01	0.2796E 05	0.1191E 08	0.1537E 08	0.7887E 07	0.1018E 08	0.6865E 10
24.50	0.1016E 01	0.2796E 05	0.1242E 08	0.1602E 08	0.8216E 07	0.1060E 08	0.7154E 10
25.00	0.1014E 01	0.2795E 05	0.1294E 08	0.1669E 08	0.8551E 07	0.1104E 08	0.7449E 10
25.50	0.1022E 01	0.2795E 05	0.1347E 08	0.1738E 08	0.8892E 07	0.1148E 08	0.7749E 10
26.00	0.1030E 01	0.2795E 05	0.1401E 08	0.1807E 08	0.9241E 07	0.1193E 08	0.8056E 10
26.50	0.1042E 01	0.2795E 05	0.1456E 08	0.1878E 08	0.9596E 07	0.1239E 08	0.8369E 10
27.00	0.1054E 01	0.2794E 05	0.1512E 08	0.1950E 08	0.9958E 07	0.1285E 08	0.8687E 10
27.50	0.1054E 01	0.2794E 05	0.1569E 08	0.2024E 08	0.1033E 08	0.1333E 08	0.9012E 10
28.00	0.1055E 01	0.2794E 05	0.1628E 08	0.2099E 08	0.1070E 08	0.1381E 08	0.9343E 10
28.50	0.1052E 01	0.2793E 05	0.1687E 08	0.2175E 08	0.1109E 08	0.1431E 08	0.9679E 10
29.00	0.1050E 01	0.2793E 05	0.1747E 08	0.2253E 08	0.1147E 08	0.1481E 08	0.1002E 11
29.50	0.1069E 01	0.2793E 05	0.1809E 08	0.2332E 08	0.1187E 08	0.1532E 08	0.1037E 11
30.00	0.1088E 01	0.2793E 05	0.1871E 08	0.2412E 08	0.1227E 08	0.1584E 08	0.1072E 11
30.50	0.1082E 01	0.2792E 05	0.1935E 08	0.2494E 08	0.1268E 08	0.1637E 08	0.1108E 11
31.00	0.1076E 01	0.2792E 05	0.1999E 08	0.2577E 08	0.1310E 08	0.1691E 08	0.1145E 11
31.50	0.1067E 01	0.2792E 05	0.2065E 08	0.2661E 08	0.1352E 08	0.1745E 08	0.1182E 11
32.00	0.1058E 01	0.2792E 05	0.2131E 08	0.2747E 08	0.1395E 08	0.1801E 08	0.1220E 11
32.50	0.1069E 01	0.2791E 05	0.2199E 08	0.2834E 08	0.1439E 08	0.1857E 08	0.1259E 11
33.00	0.1080E 01	0.2791E 05	0.2268E 08	0.2923E 08	0.1483E 08	0.1914E 08	0.1298E 11
33.50	0.1096E 01	0.2791E 05	0.2337E 08	0.3013E 08	0.1528E 08	0.1972E 08	0.1337E 11
34.00	0.1112E 01	0.2791E 05	0.2408E 08	0.3104E 08	0.1574E 08	0.2031E 08	0.1377E 11

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 24.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.1001E 01	0.	0.2308E 05	0.4365E 05	0.4365E 05	0.5632E 05	0.3239E 08
1.04	0.1000E 01	0.	0.2396E 05	0.4523E 05	0.4523E 05	0.5835E 05	0.3356E 08
1.07	0.1001E 01	0.	0.2483E 05	0.4688E 05	0.4688E 05	0.6049E 05	0.3479E 08
1.10	0.1000E 01	0.	0.2570E 05	0.4861E 05	0.4861E 05	0.6272E 05	0.3607E 08
1.20	0.1000E 01	0.	0.2915E 05	0.5487E 05	0.5487E 05	0.7079E 05	0.4072E 08
1.30	0.1000E 01	0.	0.3318E 05	0.6185E 05	0.6185E 05	0.7979E 05	0.4590E 08
1.40	0.1000E 01	0.	0.3781E 05	0.6949E 05	0.6949E 05	0.8966E 05	0.5157E 08
1.50	0.1000E 01	0.4254E 05	0.4306E 05	0.7779E 05	0.7779E 05	0.1004E 06	0.5773E 08
1.60	0.1000E 01	0.4319E 05	0.4893E 05	0.8672E 05	0.8672E 05	0.1119E 06	0.6435E 08
1.70	0.1000E 01	0.4323E 05	0.5540E 05	0.9627E 05	0.9627E 05	0.1242E 06	0.7144E 08
1.80	0.1000E 01	0.4327E 05	0.6247E 05	0.1064E 06	C.1064E 06	0.1373E 06	0.7898E 08
1.90	0.1000E 01	0.4331E 05	0.7011E 05	0.1172E 06	0.1172E 06	0.1512E 06	0.8696E 08
2.00	0.1000E 01	0.4335E 05	0.7832E 05	0.1286E 06	0.1286E 06	0.1659E 06	0.9540E 08
2.20	0.1000E 01	0.4335E 05	0.9636E 05	0.1531E 06	0.1531E 06	0.1975E 06	0.1136E 09
2.40	0.1001E 01	0.4332E 05	0.1165E 06	0.1800E 06	0.1800E 06	0.2322E 06	0.1336E 09
2.60	0.1001E 01	0.4330E 05	0.1386E 06	0.2093E 06	0.2093E 06	0.2700E 06	0.1553E 09
2.80	0.1001E 01	0.4327E 05	0.1627E 06	0.2409E 06	0.2409E 06	0.3108E 06	0.1788E 09
3.00	0.1001E 01	0.4325E 05	0.1887E 06	0.2749E 06	0.2749E 06	0.3547E 06	0.2040E 09
3.20	0.1001E 01	0.4322E 05	0.2167E 06	0.3112E 06	0.3112E 06	0.4016E 06	0.2310E 09
3.40	0.1001E 01	0.4320E 05	0.2465E 06	0.3499E 06	0.3499E 06	0.4515E 06	0.2597E 09
3.60	0.1001E 01	0.4317E 05	0.2782E 06	0.3910E 06	0.3910E 06	0.5045E 06	0.2902E 09
3.80	0.1001E 01	0.4315E 05	0.3117E 06	0.4344E 06	0.4344E 06	0.5605E 06	0.3224E 09
4.00	0.1000E 01	0.4312E 05	0.3471E 06	0.4802E 06	0.4802E 06	0.6195E 06	0.3563E 09
4.20	0.1002E 01	0.4312E 05	0.3843E 06	0.5283E 06	0.5283E 06	0.6816E 06	0.3920E 09
4.40	0.1001E 01	0.4312E 05	0.4234E 06	0.5787E 06	0.5787E 06	0.7467E 06	0.4295E 09
4.60	0.1001E 01	0.4312E 05	0.4643E 06	0.6315E 06	0.6315E 06	0.8148E 06	0.4687E 09
4.80	0.1002E 01	0.4311E 05	0.5071E 06	0.6867E 06	0.6867E 06	0.8860E 06	0.5096E 09
5.00	0.1002E 01	0.4311E 05	0.5517E 06	0.7442E 06	0.7442E 06	0.9602E 06	0.5523E 09

DESIGN JET MACH NUMBER = 24.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1002E 01	0.4311E 05	0.5517E 06	0.7442E 06	0.7442E 06	0.9602E 06	0.5523E 09
5.50	0.1002E 01	0.4311E 05	0.6712E 06	0.8982E 06	0.8982E 06	0.1159E 07	0.6666E 09
6.00	0.1003E 01	0.4310E 05	0.8021E 06	0.1067E 07	0.1067E 07	0.1377E 07	0.7918E 09
6.50	0.1004E 01	0.4310E 05	0.9445E 06	0.1250E 07	0.1250E 07	0.1613E 07	0.9279E 09
7.00	0.1004E 01	0.4310E 05	0.1098E 07	0.1448E 07	0.1448E 07	0.1869E 07	0.1075E 10
7.50	0.1003E 01	0.4309E 05	0.1263E 07	0.1661E 07	0.1661E 07	0.2143E 07	0.1233E 10
8.00	0.1002E 01	0.4309E 05	0.1440E 07	0.1889E 07	0.1889E 07	0.2437E 07	0.1402E 10
8.50	0.1003E 01	0.4308E 05	0.1628E 07	0.2131E 07	0.2131E 07	0.2749E 07	0.1581E 10
9.00	0.1003E 01	0.4308E 05	0.1827E 07	0.2387E 07	0.2387E 07	0.3080E 07	0.1772E 10
9.50	0.1006E 01	0.4308E 05	0.2038E 07	0.2659E 07	0.2659E 07	0.3431E 07	0.1973E 10
10.00	0.1008E 01	0.4307E 05	0.2260E 07	0.2945E 07	0.2945E 07	0.3800E 07	0.2185E 10
10.50	0.1010E 01	0.4307E 05	0.2494E 07	0.3246E 07	0.3246E 07	0.4188E 07	0.2409E 10
11.00	0.1012E 01	0.4306E 05	0.3559E 07	0.4628E 07	0.2722E 07	0.3511E 07	0.2643E 10
11.50	0.1010E 01	0.4306E 05	0.3959E 07	0.5143E 07	0.2926E 07	0.3775E 07	0.2888E 10
12.00	0.1007E 01	0.4305E 05	0.4352E 07	0.5649E 07	0.3158E 07	0.4075E 07	0.3144E 10
12.50	0.1010E 01	0.4305E 05	0.4755E 07	0.6170E 07	0.3405E 07	0.4394E 07	0.3410E 10
13.00	0.1013E 01	0.4305E 05	0.5173E 07	0.6707E 07	0.3665E 07	0.4729E 07	0.3688E 10
13.50	0.1015E 01	0.4304E 05	0.5605E 07	0.7264E 07	0.3936E 07	0.5078E 07	0.3977E 10
14.00	0.1017E 01	0.4304E 05	0.6052E 07	0.7840E 07	0.4219E 07	0.5443E 07	0.4276E 10
14.50	0.1017E 01	0.4303E 05	0.6515E 07	0.8436E 07	0.4512E 07	0.5821E 07	0.4586E 10
15.00	0.1017E 01	0.4303E 05	0.6993E 07	0.9052E 07	0.4816E 07	0.6214E 07	0.4908E 10
15.50	0.1013E 01	0.4303E 05	0.7488E 07	0.9688E 07	0.5131E 07	0.6620E 07	0.5240E 10
16.00	0.1009E 01	0.4302E 05	0.7998E 07	0.1035E 08	0.5456E 07	0.7040E 07	0.5583E 10
16.50	0.1015E 01	0.4302E 05	0.8524E 07	0.1102E 08	0.5792E 07	0.7473E 07	0.5936E 10
17.00	0.1021E 01	0.4301E 05	0.9066E 07	0.1172E 08	0.6139E 07	0.7920E 07	0.6301E 10
17.50	0.1024E 01	0.4301E 05	0.9624E 07	0.1244E 08	0.6496E 07	0.8381E 07	0.6677E 10
18.00	0.1026E 01	0.4301E 05	0.1020E 08	0.1318E 08	0.6863E 07	0.8855E 07	0.7063E 10
18.50	0.1028E 01	0.4300E 05	0.1079E 08	0.1394E 08	0.7241E 07	0.9343E 07	0.7461E 10
19.00	0.1029E 01	0.4300E 05	0.1139E 08	0.1472E 08	0.7630E 07	0.9844E 07	0.7869E 10
19.50	0.1033E 01	0.4299E 05	0.1202E 08	0.1552E 08	0.8029E 07	0.1036E 08	0.8288E 10

DESIGN JET MACH NUMBER = 24.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.1033E 01	0.4299E 05	0.1202E 08	0.1552E 08	0.8029E 07	0.1036E 08	0.8288E 10
20.00	0.1036E 01	0.4299E 05	0.1265E 08	0.1634E 08	0.8438E 07	0.1089E 08	0.8718E 10
20.50	0.1030E 01	0.4299E 05	0.1331E 08	0.1718E 08	0.8858E 07	0.1143E 08	0.9159E 10
21.00	0.1025E 01	0.4298E 05	0.1398E 08	0.1805E 08	0.9288E 07	0.1198E 08	0.9611E 10
21.50	0.1035E 01	0.4298E 05	0.1467E 08	0.1893E 08	0.9729E 07	0.1255E 08	0.1007E 11
22.00	0.1045E 01	0.4297E 05	0.1537E 08	0.1984E 08	0.1018E 08	0.1313E 08	0.1055E 11
22.50	0.1042E 01	0.4297E 05	0.1609E 08	0.2076E 08	0.1064E 08	0.1373E 08	0.1103E 11
23.00	0.1040E 01	0.4296E 05	0.1682E 08	0.2171E 08	0.1111E 08	0.1434E 08	0.1153E 11
23.50	0.1048E 01	0.4296E 05	0.1757E 08	0.2268E 08	0.1160E 08	0.1496E 08	0.1203E 11
24.00	0.1056E 01	0.4296E 05	0.1834E 08	0.2366E 08	0.1209E 08	0.1560E 08	0.1255E 11
24.50	0.1057E 01	0.4295E 05	0.1912E 08	0.2467E 08	0.1259E 08	0.1625E 08	0.1308E 11
25.00	0.1058E 01	0.4295E 05	0.1992E 08	0.2570E 08	0.1310E 08	0.1691E 08	0.1362E 11
25.50	0.1032E 01	0.4294E 05	0.2074E 08	0.2675E 08	0.1363E 08	0.1758E 08	0.1417E 11
26.00	0.1006E 01	0.4294E 05	0.2157E 08	0.2782E 08	0.1416E 08	0.1827E 08	0.1473E 11
26.50	0.1025E 01	0.4294E 05	0.2242E 08	0.2891E 08	0.1471E 08	0.1898E 08	0.1530E 11
27.00	0.1044E 01	0.4293E 05	0.2328E 08	0.3003E 08	0.1526E 08	0.1969E 08	0.1588E 11
27.50	0.1043E 01	0.4293E 05	0.2416E 08	0.3116E 08	0.1583E 08	0.2042E 08	0.1648E 11
28.00	0.1043E 01	0.4292E 05	0.2506E 08	0.3231E 08	0.1640E 08	0.2116E 08	0.1708E 11
28.50	0.1039E 01	0.4292E 05	0.2597E 08	0.3349E 08	0.1699E 08	0.2192E 08	0.1770E 11
29.00	0.1035E 01	0.4292E 05	0.2690E 08	0.3468E 08	0.1759E 08	0.2269E 08	0.1832E 11
29.50	0.1057E 01	0.4291E 05	0.2784E 08	0.3590E 08	0.1819E 08	0.2347E 08	0.1896E 11
30.00	0.1078E 01	0.4291E 05	0.2881E 08	0.3714E 08	0.1881E 08	0.2427E 08	0.1961E 11
30.50	0.1071E 01	0.4290E 05	0.2978E 08	0.3840E 08	0.1944E 08	0.2508E 08	0.2027E 11
31.00	0.1064E 01	0.4290E 05	0.3078E 08	0.3967E 08	0.2008E 08	0.2590E 08	0.2094E 11
31.50	0.1051E 01	0.4289E 05	0.3178E 08	0.4097E 08	0.2073E 08	0.2674E 08	0.2162E 11
32.00	0.1038E 01	0.4289E 05	0.3281E 08	0.4229E 08	0.2138E 08	0.2759E 08	0.2231E 11
32.50	0.1051E 01	0.4289E 05	0.3385E 08	0.4363E 08	0.2205E 08	0.2845E 08	0.2301E 11
33.00	0.1064E 01	0.4288E 05	0.3491E 08	0.4500E 08	0.2273E 08	0.2933E 08	0.2372E 11
33.50	0.1082E 01	0.4288E 05	0.3598E 08	0.4638E 08	0.2342E 08	0.3022E 08	0.2445E 11
34.00	0.1100E 01	0.4287E 05	0.3707E 08	0.4778E 08	0.2412E 08	0.3112E 08	0.2518E 11

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 26.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.1001E 01	0.	0.3429E 05	0.6485E 05	0.6485E 05	0.8364E 05	0.5647E 08
1.04	0.1000E 01	0.	0.3559E 05	0.6719E 05	0.6719E 05	0.8666E 05	0.5851E 08
1.07	0.1001E 01	0.	0.3689E 05	0.6965E 05	0.6965E 05	0.8984E 05	0.6065E 08
1.10	0.1000E 01	0.	0.3819E 05	0.7222E 05	0.7222E 05	0.9315E 05	0.6289E 08
1.20	0.1000E 01	0.	0.4331E 05	0.8152E 05	0.8152E 05	0.1051E 06	0.7099E 08
1.30	0.1000E 01	0.	0.4930E 05	0.9188E 05	0.9188E 05	0.1185E 06	0.8001E 08
1.40	0.1000E 01	0.	0.5618E 05	0.1032E 06	0.1032E 06	0.1332E 06	0.8991E 08
1.50	0.1000E 01	0.6320E 05	0.6398E 05	0.1156E 06	0.1156E 06	0.1491E 06	0.1006E 09
1.60	0.1000E 01	0.6417E 05	0.7269E 05	0.1288E 06	0.1288E 06	0.1662E 06	0.1122E 09
1.70	0.1000E 01	0.6423E 05	0.8231E 05	0.1430E 06	0.1430E 06	0.1845E 06	0.1245E 09
1.80	0.1000E 01	0.6428E 05	0.9281E 05	0.1581E 06	0.1581E 06	0.2039E 06	0.1377E 09
1.90	0.1000E 01	0.6434E 05	0.1042E 06	0.1741E 06	0.1741E 06	0.2246E 06	0.1516E 09
2.00	0.1000E 01	0.6440E 05	0.1164E 06	0.1910E 06	0.1910E 06	0.2463E 06	0.1663E 09
2.20	0.1000E 01	0.6440E 05	0.1432E 06	0.2274E 06	0.2274E 06	0.2933E 06	0.1980E 09
2.40	0.1001E 01	0.6436E 05	0.1731E 06	0.2674E 06	0.2674E 06	0.3449E 06	0.2329E 09
2.60	0.1001E 01	0.6432E 05	0.2059E 06	0.3109E 06	0.3109E 06	0.4010E 06	0.2707E 09
2.80	0.1001E 01	0.6429E 05	0.2417E 06	0.3579E 06	0.3579E 06	0.4616E 06	0.3117E 09
3.00	0.1001E 01	0.6425E 05	0.2804E 06	0.4084E 06	0.4084E 06	0.5267E 06	0.3556E 09
3.20	0.1001E 01	0.6421E 05	0.3219E 06	0.4624E 06	0.4624E 06	0.5964E 06	0.4027E 09
3.40	0.1001E 01	0.6417E 05	0.3662E 06	0.5199E 06	0.5199E 06	0.6706E 06	0.4527E 09
3.60	0.1001E 01	0.6414E 05	0.4133E 06	0.5809E 06	0.5809E 06	0.7492E 06	0.5059E 09
3.80	0.1001E 01	0.6410E 05	0.4631E 06	0.6454E 06	0.6454E 06	0.8324E 06	0.5620E 09
4.00	0.1000E 01	0.6406E 05	0.5157E 06	0.7133E 06	0.7133E 06	0.9201E 06	0.6212E 09
4.20	0.1001E 01	0.6406E 05	0.5710E 06	0.7848E 06	0.7848E 06	0.1012E 07	0.6835E 09
4.40	0.1000E 01	0.6406E 05	0.6291E 06	0.8598E 06	0.8598E 06	0.1109E 07	0.7487E 09
4.60	0.1002E 01	0.6405E 05	0.6898E 06	0.9382E 06	0.9382E 06	0.1210E 07	0.8171E 09
4.80	0.1002E 01	0.6405E 05	0.7534E 06	0.1020E 07	0.1020E 07	0.1316E 07	0.8884E 09
5.00	0.1001E 01	0.6405E 05	0.8196E 06	0.1106E 07	0.1106E 07	0.1426E 07	0.9628E 09

DESIGN JET MACH NUMBER = 26.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1001E 01	0.6405E 05	0.8196E 06	0.1106E 07	0.1106E 07	0.1426E 07	0.9628E 09
5.50	0.1002E 01	0.6404E 05	0.9971E 06	0.1334E 07	0.1334E 07	0.1721E 07	0.1162E 10
6.00	0.1003E 01	0.6404E 05	0.1192E 07	0.1585E 07	0.1585E 07	0.2045E 07	0.1380E 10
6.50	0.1003E 01	0.6403E 05	0.1403E 07	0.1858E 07	0.1858E 07	0.2396E 07	0.1618E 10
7.00	0.1004E 01	0.6402E 05	0.1632E 07	0.2152E 07	0.2152E 07	0.2776E 07	0.1874E 10
7.50	0.1002E 01	0.6402E 05	0.1877E 07	0.2468E 07	0.2468E 07	0.3183E 07	0.2149E 10
8.00	0.1000E 01	0.6401E 05	0.2139E 07	0.2806E 07	0.2806E 07	0.3619E 07	0.2443E 10
8.50	0.1001E 01	0.6401E 05	0.2419E 07	0.3165E 07	0.3165E 07	0.4083E 07	0.2757E 10
9.00	0.1002E 01	0.6400E 05	0.2715E 07	0.3547E 07	0.3547E 07	0.4575E 07	0.3089E 10
9.50	0.1005E 01	0.6399E 05	0.3028E 07	0.3950E 07	0.3950E 07	0.5095E 07	0.3440E 10
10.00	0.1008E 01	0.6399E 05	0.3358E 07	0.4375E 07	0.4375E 07	0.5643E 07	0.3810E 10
10.50	0.1010E 01	0.6398E 05	0.3705E 07	0.4822E 07	0.4822E 07	0.6220E 07	0.4199E 10
11.00	0.1011E 01	0.6398E 05	0.5330E 07	0.6930E 07	0.4010E 07	0.5172E 07	0.4607E 10
11.50	0.1009E 01	0.6397E 05	0.5904E 07	0.7670E 07	0.4329E 07	0.5583E 07	0.5034E 10
12.00	0.1006E 01	0.6396E 05	0.6484E 07	0.8418E 07	0.4676E 07	0.6032E 07	0.5481E 10
12.50	0.1009E 01	0.6396E 05	0.7083E 07	0.9190E 07	0.5044E 07	0.6506E 07	0.5946E 10
13.00	0.1012E 01	0.6395E 05	0.7703E 07	0.9988E 07	0.5430E 07	0.7004E 07	0.6430E 10
13.50	0.1014E 01	0.6395E 05	0.8345E 07	0.1082E 08	0.5833E 07	0.7523E 07	0.6933E 10
14.00	0.1017E 01	0.6394E 05	0.9010E 07	0.1167E 08	0.6252E 07	0.8064E 07	0.7455E 10
14.50	0.1016E 01	0.6393E 05	0.9699E 07	0.1256E 08	0.6687E 07	0.8625E 07	0.7996E 10
15.00	0.1016E 01	0.6393E 05	0.1041E 08	0.1347E 08	0.7138E 07	0.9207E 07	0.8556E 10
15.50	0.1011E 01	0.6392E 05	0.1115E 08	0.1442E 08	0.7606E 07	0.9810E 07	0.9135E 10
16.00	0.1006E 01	0.6392E 05	0.1190E 08	0.1540E 08	0.8088E 07	0.1043E 08	0.9733E 10
16.50	0.1013E 01	0.6391E 05	0.1269E 08	0.1641E 08	0.8587E 07	0.1108E 08	0.1035E 11
17.00	0.1020E 01	0.6390E 05	0.1349E 08	0.1744E 08	0.9101E 07	0.1174E 08	0.1099E 11
17.50	0.1022E 01	0.6390E 05	0.1432E 08	0.1851E 08	0.9630E 07	0.1242E 08	0.1164E 11
18.00	0.1024E 01	0.6389E 05	0.1518E 08	0.1961E 08	0.1018E 08	0.1312E 08	0.1231E 11
18.50	0.1026E 01	0.6388E 05	0.1605E 08	0.2074E 08	0.1074E 08	0.1385E 08	0.1301E 11
19.00	0.1028E 01	0.6388E 05	0.1696E 08	0.2190E 08	0.1131E 08	0.1459E 08	0.1372E 11
19.50	0.1031E 01	0.6387E 05	0.1788E 08	0.2310E 08	0.1190E 08	0.1535E 08	0.1445E 11

DESIGN JET MACH NUMBER = 26.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.1031E 01	0.6387E 05	0.1788E 08	0.2310E 08	0.1190E 08	0.1535E 08	0.1445E 11
20.00	0.1034E 01	0.6387E 05	0.1883E 08	0.2432E 08	0.1251E 08	0.1614E 08	0.1520E 11
20.50	0.1028E 01	0.6386E 05	0.1981E 08	0.2557E 08	0.1313E 08	0.1694E 08	0.1597E 11
21.00	0.1022E 01	0.6385E 05	0.2080E 08	0.2686E 08	0.1377E 08	0.1776E 08	0.1676E 11
21.50	0.1032E 01	0.6385E 05	0.2182E 08	0.2817E 08	0.1443E 08	0.1861E 08	0.1756E 11
22.00	0.1043E 01	0.6384E 05	0.2287E 08	0.2952E 08	0.1509E 08	0.1947E 08	0.1839E 11
22.50	0.1040E 01	0.6384E 05	0.2394E 08	0.3090E 08	0.1578E 08	0.2035E 08	0.1923E 11
23.00	0.1037E 01	0.6383E 05	0.2503E 08	0.3230E 08	0.1648E 08	0.2125E 08	0.2010E 11
23.50	0.1045E 01	0.6382E 05	0.2615E 08	0.3374E 08	0.1719E 08	0.2218E 08	0.2098E 11
24.00	0.1053E 01	0.6382E 05	0.2729E 08	0.3521E 08	0.1792E 08	0.2312E 08	0.2188E 11
24.50	0.1055E 01	0.6381E 05	0.2846E 08	0.3671E 08	0.1867E 08	0.2408E 08	0.2280E 11
25.00	0.1056E 01	0.6381E 05	0.2965E 08	0.3824E 08	0.1943E 08	0.2506E 08	0.2374E 11
25.50	0.1061E 01	0.6380E 05	0.3086E 08	0.3981E 08	0.2021E 08	0.2607E 08	0.2470E 11
26.00	0.1065E 01	0.6379E 05	0.3210E 08	0.4140E 08	0.2100E 08	0.2709E 08	0.2568E 11
26.50	0.1052E 01	0.6379E 05	0.3336E 08	0.4302E 08	0.2181E 08	0.2813E 08	0.2667E 11
27.00	0.1039E 01	0.6378E 05	0.3464E 08	0.4468E 08	0.2263E 08	0.2919E 08	0.2769E 11
27.50	0.1038E 01	0.6378E 05	0.3595E 08	0.4637E 08	0.2347E 08	0.3027E 08	0.2872E 11
28.00	0.1037E 01	0.6377E 05	0.3729E 08	0.4808E 08	0.2432E 08	0.3137E 08	0.2978E 11
28.50	0.1032E 01	0.6376E 05	0.3864E 08	0.4983E 08	0.2519E 08	0.3250E 08	0.3085E 11
29.00	0.1026E 01	0.6376E 05	0.4003E 08	0.5161E 08	0.2608E 08	0.3364E 08	0.3194E 11
29.50	0.1050E 01	0.6375E 05	0.4143E 08	0.5342E 08	0.2698E 08	0.3480E 08	0.3305E 11
30.00	0.1074E 01	0.6374E 05	0.4286E 08	0.5526E 08	0.2789E 08	0.3598E 08	0.3418E 11
30.50	0.1066E 01	0.6374E 05	0.4431E 08	0.5713E 08	0.2883E 08	0.3718E 08	0.3533E 11
31.00	0.1058E 01	0.6373E 05	0.4579E 08	0.5903E 08	0.2977E 08	0.3840E 08	0.3650E 11
31.50	0.1042E 01	0.6373E 05	0.4729E 08	0.6097E 08	0.3073E 08	0.396[illegible]E 08	0.3768E 11
32.00	0.1025E 01	0.6372E 05	0.4882E 08	0.6293E 08	0.3171E 08	0.4090E 08	0.3889E 11
32.50	0.1041E 01	0.6371E 05	0.5037E 08	0.6493E 08	0.3270E 08	0.4218E 08	0.4011E 11
33.00	0.1057E 01	0.6371E 05	0.5194E 08	0.6695E 08	0.3371E 08	0.4348E 08	0.4136E 11
33.50	0.1076E 01	0.6370E 05	0.5354E 08	0.6901E 08	0.3473E 08	0.4480E 08	0.4262E 11
34.00	0.1095E 01	0.6370E 05	0.5516E 08	0.7110E 08	0.3577E 08	0.4614E 08	0.4390E 11

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 28.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.1001E 01	0.	0.4950E 05	0.9361E 05	0.9361E 05	0.1207E 06	0.9453E 08
1.04	0.1000E 01	0.	0.5137E 05	0.9699E 05	0.9699E 05	0.1251E 06	0.9795E 08
1.07	0.1001E 01	0.	0.5325E 05	0.1005E 06	0.1005E 06	0.1296E 06	0.1015E 09
1.10	0.1000E 01	0.	0.5512E 05	0.1042E 06	0.1042E 06	0.1344E 06	0.1053E 09
1.20	0.1000E 01	0.	0.6252E 05	0.1177E 06	0.1177E 06	0.1517E 06	0.1188E 09
1.30	0.1000E 01	0.	0.7116E 05	0.1326E 06	0.1326E 06	0.1710E 06	0.1339E 09
1.40	0.1000E 01	0.	0.8109E 05	0.1490E 06	0.1490E 06	0.1922E 06	0.1505E 09
1.50	0.1000E 01	0.9123E 05	0.9235E 05	0.1668E 06	0.1668E 06	0.2151E 06	0.1685E 09
1.60	0.1000E 01	0.9263E 05	0.1049E 06	0.1860E 06	0.1860E 06	0.2398E 06	0.1878E 09
1.70	0.1000E 01	0.9271E 05	0.1188E 06	0.2064E 06	0.2064E 06	0.2662E 06	0.2085E 09
1.80	0.1000E 01	0.9279E 05	0.1340E 06	0.2282E 06	0.2282E 06	0.2943E 06	0.2305E 09
1.90	0.1000E 01	0.9288E 05	0.1504E 06	0.2513E 06	0.2513E 06	0.3241E 06	0.2538E 09
2.00	0.1000E 01	0.9296E 05	0.1680E 06	0.2757E 06	0.2757E 06	0.3555E 06	0.2784E 09
2.20	0.1000E 01	0.9296E 05	0.2066E 06	0.3283E 06	0.3283E 06	0.4233E 06	0.3315E 09
2.40	0.1001E 01	0.9290E 05	0.2498E 06	0.3860E 06	0.3860E 06	0.4977E 06	0.3898E 09
2.60	0.1001E 01	0.9285E 05	0.2973E 06	0.4487E 06	0.4487E 06	0.5787E 06	0.4532E 09
2.80	0.1001E 01	0.9280E 05	0.3490E 06	0.5166E 06	0.5166E 06	0.6661E 06	0.5217E 09
3.00	0.1001E 01	0.9274E 05	0.4048E 06	0.5895E 06	0.5895E 06	0.7602E 06	0.5953E 09
3.20	0.1001E 01	0.9269E 05	0.4647E 06	0.6674E 06	0.6674E 06	0.8607E 06	0.6741E 09
3.40	0.1001E 01	0.9263E 05	0.5286E 06	0.7504E 06	0.7504E 06	0.9677E 06	0.7579E 09
3.60	0.1001E 01	0.9258E 05	0.5965E 06	0.8385E 06	0.8385E 06	0.1081E 07	0.8468E 09
3.80	0.1001E 01	0.9253E 05	0.6685E 06	0.9316E 06	0.9316E 06	0.1201E 07	0.9408E 09
4.00	0.1000E 01	0.9247E 05	0.7444E 06	0.1030E 07	0.1030E 07	0.1328E 07	0.1040E 10
4.20	0.1001E 01	0.9247E 05	0.8242E 06	0.1133E 07	0.1133E 07	0.1461E 07	0.1144E 10
4.40	0.1000E 01	0.9247E 05	0.9080E 06	0.1241E 07	0.1241E 07	0.1600E 07	0.1253E 10
4.60	0.1002E 01	0.9246E 05	0.9958E 06	0.1354E 07	0.1354E 07	0.1746E 07	0.1368E 10
4.80	0.1002E 01	0.9246E 05	0.1087E 07	0.1473E 07	0.1473E 07	0.1899E 07	0.1487E 10
5.00	0.1001E 01	0.9246E 05	0.1183E 07	0.1596E 07	0.1596E 07	0.2058E 07	0.1612E 10

DESIGN JET MACH NUMBER = 28.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1001E 01	0.9246E 05	0.1183E 07	0.1596E 07	0.1596E 07	0.2058E 07	0.1612E 10
5.50	0.1002E 01	0.9245E 05	0.1439E 07	0.1926E 07	0.1926E 07	0.2484E 07	0.1945E 10
6.00	0.1003E 01	0.9244E 05	0.1720E 07	0.2288E 07	0.2288E 07	0.2951E 07	0.2311E 10
6.50	0.1003E 01	0.9243E 05	0.2025E 07	0.2681E 07	0.2681E 07	0.3458E 07	0.2708E 10
7.00	0.1004E 01	0.9242E 05	0.2355E 07	0.3106E 07	0.3106E 07	0.4005E 07	0.3137E 10
7.50	0.1002E 01	0.9241E 05	0.2709E 07	0.3562E 07	0.3562E 07	0.4594E 07	0.3598E 10
8.00	0.1000E 01	0.9240E 05	0.3088E 07	0.4050E 07	0.4050E 07	0.5223E 07	0.4090E 10
8.50	0.1004E 01	0.9239E 05	0.3491E 07	0.4569E 07	0.4569E 07	0.5892E 07	0.4615E 10
9.00	0.1008E 01	0.9238E 05	0.3919E 07	0.5120E 07	0.5120E 07	0.6602E 07	0.5171E 10
9.50	0.1008E 01	0.9238E 05	0.4371E 07	0.5702E 07	0.5702E 07	0.7353E 07	0.5758E 10
10.00	0.1008E 01	0.9237E 05	0.4847E 07	0.6316E 07	0.6316E 07	0.8144E 07	0.6378E 10
10.50	0.1009E 01	0.9236E 05	0.5348E 07	0.6961E 07	0.6961E 07	0.8976E 07	0.7030E 10
11.00	0.1011E 01	0.9235E 05	0.7727E 07	0.1005E 08	0.5762E 07	0.7430E 07	0.7713E 10
11.50	0.1008E 01	0.9234E 05	0.8545E 07	0.1110E 08	0.6230E 07	0.8034E 07	0.8428E 10
12.00	0.1005E 01	0.9233E 05	0.9381E 07	0.1218E 08	0.6734E 07	0.8683E 07	0.9174E 10
12.50	0.1009E 01	0.9232E 05	0.1025E 08	0.1329E 08	0.7265E 07	0.9369E 07	0.9953E 10
13.00	0.1012E 01	0.9231E 05	0.1114E 08	0.1444E 08	0.7822E 07	0.1009E 08	0.1076E 11
13.50	0.1014E 01	0.9231E 05	0.1207E 08	0.1564E 08	0.8403E 07	0.1084E 08	0.1161E 11
14.00	0.1016E 01	0.9230E 05	0.1303E 08	0.1688E 08	0.9008E 07	0.1162E 08	0.1248E 11
14.50	0.1016E 01	0.9229E 05	0.1402E 08	0.1816E 08	0.9635E 07	0.1243E 08	0.1338E 11
15.00	0.1016E 01	0.9228E 05	0.1505E 08	0.1948E 08	0.1029E 08	0.1326E 08	0.1432E 11
15.50	0.1009E 01	0.9227E 05	0.1611E 08	0.2085E 08	0.1096E 08	0.1413E 08	0.1529E 11
16.00	0.1003E 01	0.9226E 05	0.1721E 08	0.2226E 08	0.1166E 08	0.1503E 08	0.1629E 11
16.50	0.1011E 01	0.9225E 05	0.1834E 08	0.2372E 08	0.1237E 08	0.1596E 08	0.1733E 11
17.00	0.1019E 01	0.9224E 05	0.1950E 08	0.2522E 08	0.1312E 08	0.1691E 08	0.1839E 11
17.50	0.1021E 01	0.9224E 05	0.2070E 08	0.2676E 08	0.1388E 08	0.1790E 08	0.1949E 11
18.00	0.1023E 01	0.9223E 05	0.2194E 08	0.2835E 08	0.1466E 08	0.1891E 08	0.2061E 11
18.50	0.1025E 01	0.9222E 05	0.2321E 08	0.2998E 08	0.1547E 08	0.1995E 08	0.2177E 11
19.00	0.1027E 01	0.9221E 05	0.2451E 08	0.3166E 08	0.1630E 08	0.2102E 08	0.2297E 11
19.50	0.1030E 01	0.9220E 05	0.2585E 08	0.3338E 08	0.1716E 08	0.2212E 08	0.2419E 11

DESIGN JET MACH NUMBER = 28.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.1030E 01	0.9220E 05	0.2585E 08	0.3338E 08	0.1716E 08	0.2212E 08	0.2419E 11
20.00	0.1033E 01	0.9219E 05	0.2722E 08	0.3515E 08	0.1803E 08	0.2325E 08	0.2544E 11
20.50	0.1027E 01	0.9218E 05	0.2863E 08	0.3696E 08	0.1893E 08	0.2441E 08	0.2673E 11
21.00	0.1020E 01	0.9217E 05	0.3007E 08	0.3882E 08	0.1985E 08	0.2560E 08	0.2805E 11
21.50	0.1031E 01	0.9216E 05	0.3154E 08	0.4072E 08	0.2079E 08	0.2681E 08	0.2940E 11
22.00	0.1042E 01	0.9216E 05	0.3305E 08	0.4266E 08	0.2176E 08	0.2805E 08	0.3078E 11
22.50	0.1039E 01	0.9215E 05	0.3460E 08	0.4465E 08	0.2274E 08	0.2933E 08	0.3220E 11
23.00	0.1036E 01	0.9214E 05	0.3618E 08	0.4669E 08	0.2375E 08	0.3063E 08	0.3364E 11
23.50	0.1044E 01	0.9213E 05	0.3780E 08	0.4877E 08	0.2478E 08	0.3196E 08	0.3512E 11
24.00	0.1052E 01	0.9212E 05	0.3944E 08	0.5089E 08	0.2583E 08	0.3331E 08	0.3663E 11
24.50	0.1054E 01	0.9211E 05	0.4113E 08	0.5306E 08	0.2691E 08	0.3470E 08	0.3817E 11
25.00	0.1055E 01	0.9210E 05	0.4285E 08	0.5527E 08	0.2801E 08	0.3612E 08	0.3974E 11
25.50	0.1060E 01	0.9209E 05	0.4460E 08	0.5753E 08	0.2913E 08	0.3756E 08	0.4135E 11
26.00	0.1064E 01	0.9209E 05	0.4639E 08	0.5983E 08	0.3027E 08	0.3903E 08	0.4299E 11
26.50	0.1051E 01	0.9208E 05	0.4821E 08	0.6218E 08	0.3143E 08	0.4053E 08	0.4465E 11
27.00	0.1037E 01	0.9207E 05	0.5007E 08	0.6457E 08	0.3262E 08	0.4207E 08	0.4635E 11
27.50	0.1036E 01	0.9206E 05	0.5196E 08	0.6701E 08	0.3383E 08	0.4362E 08	0.4809E 11
28.00	0.1035E 01	0.9205E 05	0.5389E 08	0.6949E 08	0.3506E 08	0.4521E 08	0.4985E 11
28.50	0.1028E 01	0.9204E 05	0.5585E 08	0.7202E 08	0.3631E 08	0.4683E 08	0.5164E 11
29.00	0.1021E 01	0.9203E 05	0.5785E 08	0.7459E 08	0.3759E 08	0.4847E 08	0.5347E 11
29.50	0.1047E 01	0.9202E 05	0.5988E 08	0.7720E 08	0.3889E 08	0.5014E 08	0.5533E 11
30.00	0.1073E 01	0.9202E 05	0.6194E 08	0.7986E 08	0.4021E 08	0.5185E 08	0.5722E 11
30.50	0.1064E 01	0.9201E 05	0.6405E 08	0.8257E 08	0.4155E 08	0.5358E 08	0.5914E 11
31.00	0.1056E 01	0.9200E 05	0.6618E 08	0.8532E 08	0.4291E 08	0.5534E 08	0.6110E 11
31.50	0.1036E 01	0.9199E 05	0.6835E 08	0.8811E 08	0.4430E 08	0.5712E 08	0.6308E 11
32.00	0.1017E 01	0.9198E 05	0.7056E 08	0.9095E 08	0.4571E 08	0.5894E 08	0.6510E 11
32.50	0.1035E 01	0.9197E 05	0.7279E 08	0.9383E 08	0.4714E 08	0.6079E 08	0.6715E 11
33.00	0.1054E 01	0.9196E 05	0.7507E 08	0.9676E 08	0.4859E 08	0.6266E 08	0.6923E 11
33.50	0.1073E 01	0.9195E 05	0.7738E 08	0.9973E 08	0.5007E 08	0.6456E 08	0.7135E 11
34.00	0.1092E 01	0.9194E 05	0.7972E 08	0.1028E 09	0.5156E 08	0.6649E 08	0.7349E 11

PRESSURE RATIOS DEFINING THE BOUNDARIES OF
THE VARIOUS TYPES OF INTERACTION FLOWS

DESIGN JET MACH NUMBER = 30.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
1.01	0.1001E 01	0.	0.6970E 05	0.1318E 06	0.1318E 06	0.1699E 06	0.1528E 09
1.04	0.1000E 01	0.	0.7233E 05	0.1366E 06	0.1366E 06	0.1761E 06	0.1583E 09
1.07	0.1001E 01	0.	0.7497E 05	0.1416E 06	0.1416E 06	0.1825E 06	0.1641E 09
1.10	0.1000E 01	0.	0.7761E 05	0.1468E 06	0.1468E 06	0.1892E 06	0.1702E 09
1.20	0.1000E 01	0.	0.8802E 05	0.1657E 06	0.1657E 06	0.2136E 06	0.1921E 09
1.30	0.1000E 01	0.	0.1002E 06	0.1867E 06	0.1867E 06	0.2408E 06	0.2165E 09
1.40	0.1000E 01	0.	0.1142E 06	0.2098E 06	0.2098E 06	0.2705E 06	0.2433E 09
1.50	0.1000E 01	0.1285E 06	0.1300E 06	0.2349E 06	0.2349E 06	0.3028E 06	0.2723E 09
1.60	0.1000E 01	0.1304E 06	0.1477E 06	0.2618E 06	0.2618E 06	0.3376E 06	0.3035E 09
1.70	0.1000E 01	0.1305E 06	0.1673E 06	0.2907E 06	0.2907E 06	0.3747E 06	0.3370E 09
1.80	0.1000E 01	0.1307E 06	0.1886E 06	0.3213E 06	0.3213E 06	0.4143E 06	0.3725E 09
1.90	0.1000E 01	0.1308E 06	0.2117E 06	0.3538E 06	0.3538E 06	0.4562E 06	0.4102E 09
2.00	0.1000E 01	0.1309E 06	0.2365E 06	0.3882E 06	0.3882E 06	0.5004E 06	0.4500E 09
2.20	0.1000E 01	0.1309E 06	0.2909E 06	0.4622E 06	0.4622E 06	0.5959E 06	0.5358E 09
2.40	0.1001E 01	0.1308E 06	0.3517E 06	0.5434E 06	0.5434E 06	0.7006E 06	0.6300E 09
2.60	0.1001E 01	0.1307E 06	0.4186E 06	0.6318E 06	0.6318E 06	0.8146E 06	0.7325E 09
2.80	0.1001E 01	0.1307E 06	0.4913E 06	0.7273E 06	0.7273E 06	0.9377E 06	0.8432E 09
3.00	0.1001E 01	0.1306E 06	0.5699E 06	0.8300E 06	0.8300E 06	0.1070E 07	0.9622E 09
3.20	0.1001E 01	0.1305E 06	0.6543E 06	0.9398E 06	0.9398E 06	0.1212E 07	0.1089E 10
3.40	0.1001E 01	0.1304E 06	0.7443E 06	0.1057E 07	0.1057E 07	0.1362E 07	0.1225E 10
3.60	0.1001E 01	0.1304E 06	0.8399E 06	0.1181E 07	0.1181E 07	0.1522E 07	0.1369E 10
3.80	0.1001E 01	0.1303E 06	0.9412E 06	0.1312E 07	0.1312E 07	0.1691E 07	0.1521E 10
4.00	0.1000E 01	0.1302E 06	0.1048E 07	0.1450E 07	0.1450E 07	0.1869E 07	0.1681E 10
4.20	0.1001E 01	0.1302E 06	0.1161E 07	0.1595E 07	0.1595E 07	0.2057E 07	0.1849E 10
4.40	0.1000E 01	0.1302E 06	0.1279E 07	0.1747E 07	0.1747E 07	0.2253E 07	0.2026E 10
4.60	0.1002E 01	0.1302E 06	0.1402E 07	0.1907E 07	0.1907E 07	0.2459E 07	0.2211E 10
4.80	0.1002E 01	0.1302E 06	0.1531E 07	0.2073E 07	0.2073E 07	0.2673E 07	0.2404E 10
5.00	0.1001E 01	0.1302E 06	0.1666E 07	0.2247E 07	0.2247E 07	0.2897E 07	0.2605E 10

DESIGN JET MACH NUMBER = 30.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
5.00	0.1001E 01	0.1302E 06	0.1666E 07	0.2247E 07	0.2247E 07	0.2897E 07	0.2605E 10
5.50	0.1002E 01	0.1302E 06	0.2027E 07	0.2712E 07	0.2712E 07	0.3497E 07	0.3144E 10
6.00	0.1003E 01	0.1302E 06	0.2422E 07	0.3222E 07	0.3222E 07	0.4154E 07	0.3735E 10
6.50	0.1003E 01	0.1301E 06	0.2852E 07	0.3775E 07	0.3775E 07	0.4867E 07	0.4377E 10
7.00	0.1004E 01	0.1301E 06	0.3316E 07	0.4373E 07	0.4373E 07	0.5639E 07	0.5070E 10
7.50	0.1002E 01	0.1301E 06	0.3815E 07	0.5016E 07	0.5016E 07	0.6467E 07	0.5815E 10
8.00	0.1000E 01	0.1301E 06	0.4348E 07	0.5703E 07	0.5703E 07	0.7352E 07	0.6611E 10
8.50	0.1004E 01	0.1301E 06	0.4916E 07	0.6433E 07	0.6433E 07	0.8294E 07	0.7458E 10
9.00	0.1008E 01	0.1301E 06	0.5518E 07	0.7209E 07	0.7209E 07	0.9294E 07	0.8357E 10
9.50	0.1008E 01	0.1301E 06	0.6154E 07	0.8028E 07	0.8028E 07	0.1035E 08	0.9307E 10
10.00	0.1008E 01	0.1301E 06	0.6825E 07	0.8892E 07	0.8892E 07	0.1146E 08	0.1031E 11
10.50	0.1009E 01	0.1300E 06	0.7530E 07	0.9800E 07	0.9800E 07	0.1264E 08	0.1136E 11
11.00	0.1011E 01	0.1300E 06	0.1091E 08	0.1419E 08	0.8088E 07	0.1043E 08	0.1247E 11
11.50	0.1008E 01	0.1300E 06	0.1206E 08	0.1566E 08	0.8752E 07	0.1128E 08	0.1362E 11
12.00	0.1005E 01	0.1300E 06	0.1323E 08	0.1718E 08	0.9463E 07	0.1220E 08	0.1483E 11
12.50	0.1008E 01	0.1300E 06	0.1445E 08	0.1874E 08	0.1021E 08	0.1317E 08	0.1609E 11
13.00	0.1012E 01	0.1300E 06	0.1571E 08	0.2037E 08	0.1100E 08	0.1418E 08	0.1740E 11
13.50	0.1014E 01	0.1300E 06	0.1701E 08	0.2205E 08	0.1181E 08	0.1523E 08	0.1876E 11
14.00	0.1016E 01	0.1300E 06	0.1837E 08	0.2379E 08	0.1266E 08	0.1633E 08	0.2017E 11
14.50	0.1016E 01	0.1299E 06	0.1977E 08	0.2560E 08	0.1355E 08	0.1747E 08	0.2163E 11
15.00	0.1016E 01	0.1299E 06	0.2122E 08	0.2746E 08	0.1446E 08	0.1865E 08	0.2315E 11
15.50	0.1008E 01	0.1299E 06	0.2271E 08	0.2939E 08	0.1541E 08	0.1987E 08	0.2471E 11
16.00	0.1000E 01	0.1299E 06	0.2426E 08	0.3138E 08	0.1639E 08	0.2113E 08	0.2633E 11
16.50	0.1009E 01	0.1299E 06	0.2585E 08	0.3343E 08	0.1740E 08	0.2243E 08	0.2800E 11
17.00	0.1019E 01	0.1299E 06	0.2749E 08	0.3554E 08	0.1844E 08	0.2378E 08	0.2972E 11
17.50	0.1021E 01	0.1299E 06	0.2918E 08	0.3772E 08	0.1952E 08	0.2516E 08	0.3149E 11
18.00	0.1023E 01	0.1299E 06	0.3092E 08	0.3996E 08	0.2062E 08	0.2659E 08	0.3332E 11
18.50	0.1025E 01	0.1298E 06	0.3271E 08	0.4226E 08	0.2176E 08	0.2805E 08	0.3519E 11
19.00	0.1026E 01	0.1298E 06	0.3455E 08	0.4463E 08	0.2293E 08	0.2956E 08	0.3712E 11
19.50	0.1030E 01	0.1298E 06	0.3643E 08	0.4705E 08	0.2413E 08	0.3110E 08	0.3909E 11

DESIGN JET MACH NUMBER = 30.0

MS1	P I	P II	P III	P IV	P V	P VI	P VII
19.50	0.1030E 01	0.1298E 06	0.3643E 08	0.4705E 08	0.2413E 08	0.3110E 08	0.3909E 11
20.00	0.1033E 01	0.1298E 06	0.3836E 08	0.4954E 08	0.2536E 08	0.3269E 08	0.4112E 11
20.50	0.1026E 01	0.1298E 06	0.4035E 08	0.5210E 08	0.2662E 08	0.3432E 08	0.4320E 11
21.00	0.1020E 01	0.1298E 06	0.4238E 08	0.5471E 08	0.2791E 08	0.3599E 08	0.4533E 11
21.50	0.1030E 01	0.1298E 06	0.4446E 08	0.5739E 08	0.2924E 08	0.3769E 08	0.4752E 11
22.00	0.1041E 01	0.1298E 06	0.4659E 08	0.6013E 08	0.3059E 08	0.3944E 08	0.4975E 11
22.50	0.1038E 01	0.1297E 06	0.4877E 08	0.6294E 08	0.3198E 08	0.4123E 08	0.5204E 11
23.00	0.1035E 01	0.1297E 06	0.5099E 08	0.6580E 08	0.3340E 08	0.4306E 08	0.5437E 11
23.50	0.1044E 01	0.1297E 06	0.5327E 08	0.6873E 08	0.3485E 08	0.4493E 08	0.5676E 11
24.00	0.1052E 01	0.1297E 06	0.5559E 08	0.7173E 08	0.3633E 08	0.4684E 08	0.5920E 11
24.50	0.1053E 01	0.1297E 06	0.5797E 08	0.7478E 08	0.3784E 08	0.4879E 08	0.6169E 11
25.00	0.1054E 01	0.1297E 06	0.6039E 08	0.7790E 08	0.3939E 08	0.5078E 08	0.6423E 11
25.50	0.1059E 01	0.1297E 06	0.6286E 08	0.8108E 08	0.4096E 08	0.5281E 08	0.6683E 11
26.00	0.1064E 01	0.1297E 06	0.6538E 08	0.8433E 08	0.4257E 08	0.5488E 08	0.6947E 11
26.50	0.1050E 01	0.1296E 06	0.6795E 08	0.8764E 08	0.4421E 08	0.5699E 08	0.7217E 11
27.00	0.1036E 01	0.1296E 06	0.7057E 08	0.9101E 08	0.4588E 08	0.5915E 08	0.7492E 11
27.50	0.1034E 01	0.1296E 06	0.7323E 08	0.9444E 08	0.4758E 08	0.6134E 08	0.7772E 11
28.00	0.1033E 01	0.1296E 06	0.7595E 08	0.9794E 08	0.4931E 08	0.6357E 08	0.8057E 11
28.50	0.1026E 01	0.1296E 06	0.7871E 08	0.1015E 09	0.5107E 08	0.6584E 08	0.8347E 11
29.00	0.1018E 01	0.1296E 06	0.8153E 08	0.1051E 09	0.5286E 08	0.6815E 08	0.8642E 11
29.50	0.1045E 01	0.1296E 06	0.8439E 08	0.1088E 09	0.5469E 08	0.7051E 08	0.8943E 11
30.00	0.1072E 01	0.1296E 06	0.8730E 08	0.1126E 09	0.5654E 08	0.7290E 08	0.9248E 11
30.50	0.1063E 01	0.1295E 06	0.9026E 08	0.1164E 09	0.5843E 08	0.7533E 08	0.9559E 11
31.00	0.1054E 01	0.1295E 06	0.9327E 08	0.1202E 09	0.6035E 08	0.7781E 08	0.9875E 11
31.50	0.1033E 01	0.1295E 06	0.9633E 08	0.1242E 09	0.6230E 08	0.8032E 08	0.1020E 12
32.00	0.1011E 01	0.1295E 06	0.9944E 08	0.1282E 09	0.6428E 08	0.8287E 08	0.1052E 12
32.50	0.1031E 01	0.1295E 06	0.1026E 09	0.1322E 09	0.6629E 08	0.8547E 08	0.1085E 12
33.00	0.1052E 01	0.1295E 06	0.1058E 09	0.1364E 09	0.6834E 08	0.8810E 08	0.1119E 12
33.50	0.1072E 01	0.1295E 06	0.1091E 09	0.1406E 09	0.7041E 08	0.9078E 08	0.1153E 12
34.00	0.1091E 01	0.1295E 06	0.1124E 09	0.1448E 09	0.7252E 08	0.9349E 08	0.1188E 12